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USES OF ELECTRICAL ENERGY.

It may be said without any fear of contradiction that never before were so many uses of electrical energy from central-station circuits found under one roof as are now to be seen at the electrical show in Madison Square Garden. Along such lines a kindred exposition might well be given each year with advantage. The electrical manufacturer who deals with lighting or traction companies, or with a jobber, has no particular inducement or reward for going into a popular electrical show, though he does well to make a display at the annual conventions; but the central-station company has the whole great universal public for its field of possible patronage. Every effort made by way of education brings its return in the sale of energy; and every device shown in operation is needed by somebody or other. Hence we can find only words of commendation for the scope, spirit and character of the present show. It must do good. Even the exhibit of milking cows by electricity in a city where cows are not allowed has the charm of popular novelty. Probably some New Yorkers never saw a cow; a great many have never seen one milked; none before this has had a chance to see the milkmaid supplanted and her work done by electricity. And the cow evidently likes it, too!

THE NEW ILLUMINANTS AND GAS COMPETITION.

One of the important questions regarding the new electric illuminants is their probable effect upon the competition of the gas companies with their mantle burners. When the question between gas and electricity narrows down merely to the production of the highest possible candle-hours for a dollar, irrespective of quality and of convenience, the former has long been admitted to have the better of the argument. The importance of the other factors mentioned in actual practice is sufficiently well shown by the magnitude of the electric lighting industry, which has from the beginning thrived upon competition with an illuminant admittedly cheaper, candle-power for candle-power. Save in the poorer business quarters, the use of electricity to the exclusion of its rival is pretty general. In the poorer streets of shops and the like, where there has to be pinching economy in expenses, gas has the field. In residential districts of every class gas is greatly predominant where it is available, with the exception possibly of occasional small districts where the houses are of the most elaborate description. There is a considerable amount, also, of street lighting by gas for reasons of economy or politics, and a rapidly increasing use of gas for power, cooking and occasional heating.

Starting from these data, in how far will the new illuminants like graphitized and metallic-filament lamps and high-efficiency Nernsts change the situation? It is tolerably evident that where cost is the determining factor the result will hinge upon the effect of the new lamps upon the bills for an approximately equal amount of light. Wherever, for example, large

incandescent units are now in use, they can be replaced, for instance, with tungsten lamps with a considerable reduction of expense. Where gas lamps are in use, the same replacement can take place in many instances, enough probably to more than make up for the lower bills on the former class of business. In residences, however, the case is somewhat different. The very wide use of gas stoves gives gas the entrée, so to speak, and from long custom it is not easy to introduce a second service to displace gas lighting. The residential lighting on an electric service is usually upon the maximum rate, which is generally far higher relatively than the maximum rate for gas, and electric cooking and heating is progressing rather slowly for this very reason. A successful attack upon this stronghold of gas lighting requires reduction of bills, not the mere bestowal of more light for the same money. The tantalum and tungsten lamps, if the latter become available in small units, will enable some progress to be made. At anywhere near the same cost, electric lighting will be preferred by the average householder. He does not, however, gain advantage, as does the small tradesman, from increase of light for the same total cost.

Of course, many central station men affect to hold residential lighting in contempt, but we fancy few of them would really enjoy seeing the gas company step in and elbow them out of what little they had been able to secure. The gas man manages to earn pretty good dividends on residence lighting, and the more sinews of war he thus acquires, the more successfully he can push the gas-engine business on the other flank. In street lighting some of the new lamps, especially the series tungsten lamps, are going to be important. The mantle burner goes well enough in street work to give the central station man a good many bad quarter-hours. The tungsten lamp should save him these and enable enough new work to be taken on to much more than make up for decreased bills on old work. Street lighting is the one branch in which the amount of business has been very seriously held back by high costs, whether gas or electric. The average street is to-day very inadequately lighted, and unless costs are reduced, it will remain so. A lamp taking only half the usual energy for given intensity makes possible equally good lighting at reduced cost and will inevitably lead to a great increase of total business, and in a form very desirable from the standpoint of economical operation. Some of the new arcs bid fair to be of use in the same way. The modern city ought to have something like double its present amount of street illumination if the current course of civilization keeps up. At a casual overlook of the situation it appears then that in street lighting lies the most successful line of attack on the present field of competition with gas, with the new lamps as weapons. Small shops also afford a good chance, but residential work requires a radical change in the usual rates policy in order to secure the business. From a strategic standpoint, however, residence lighting, as we have frequently pointed out, is of no small importance and deserves to be cultivated.

Electric Heating on a Large Scale.

Elsewhere we print an interesting article by Mr. Charles E. Waddell describing the extensive electric heating plant installed under his supervision in Biltmore House, the Vanderbilt residence near Asheville, N. C. The present plant is the most extensive application of electric heating to household purposes yet made, and in a paper recently presented by Mr. Waddell before the Engineering Society of the Carolinas, we learn that plans are under advisement whereby the electric service will be further extended to heating the house, principally by means of water storage of heat from energy transmitted during hours of the night, the present hot-water distributing system to be utilized. That an actual economy has resulted in the substitution of electric heat is not surprising in view of the high cost of coal and the low cost of electrical energy at Asheville—the former being $11 per ton and the latter 0.85 cent per kw-hour in this instance, owing partly to the existing large storage battery plant creating a favorable load condition. On the other hand, the extensive use of electric heat to raise water to high temperatures militated against economy. While the Biltmore plant owing to its special character does not furnish a lesson in electric heating of general application, it is an excellent example of the application of engineering principles to the working out of a special problem that might not have been attacked if current general opinion as to the possibilities of such a case had been accepted. Every branch of electrical engineering has at one stage or another suffered by the application of general considerations in cases where a careful study of the special conditions would have developed new data pointing the way to success where failure had been predicted. Electric heating has in particular been handicapped by viewing its economic possibilities too largely from the thermal unit standpoint, and the real lesson from Biltmore is that no electric heating proposition should be cast aside without a close canvass of all of the conditions affecting its possibilities.

Railroad Management and Safety Devices.

The *Journal* of the Franklin Institute for April, 1907, contains an interesting paper by Mr. J. C. Irwin on the safety devices which are in general use on railways in the United States, and particularly those which are being installed in the electric zone of the New York Central Lines terminating at the Grand Central Station. Power for operating the signal system will be taken from the Port Morris and Yonkers generating stations. These stations generate three-phase, 25-cycle currents at 11 kilovolts, and transmit the energy to the sub-stations along the track. The sub-stations are equipped with rotary converters to deliver 666 volts to the track. They will also be equipped with transformers for delivering 3000-volt alternating currents to the signal transmission line. The signal transmission line, divided into suitable sections, one to each sub-station, consists of a No. 0 bare copper wire, carried on the pole line. It supplies the primary windings of step-down signal transformers, which are placed on signal bridges, and which deliver single-phase alternating currents at 50 volts pressure. One side of each secondary winding is grounded directly. The signals on the bridges are set and controlled each by an independent ¼-hp alternating-current motor at 50 volts. The current to these signal motors is turned off and on at the contact points of track relays. The track relays, in their turn, are of the induction-motor type, permanently energized by 50-volt alternating currents, but operated by low-voltage alternating currents through the track, controlled by the car wheels of the passing trains. The angular play or movement of the rotor in the track relays is limited to about one-tenth of a revolution. By this means each train sets and clears its own block signals behind it.

It is evident from the paper that careful study has been given to the problem of combining electric propulsion by direct currents, and electric automatic signalling by alternating currents, using the same track for both systems simultaneously. No amount of mechanical skill displayed in automatic safety devices on a railroad can dispense with the necessity for continued vigilance on the part of the operating crews. After every appliance that can be recommended has been installed, there will still be accidents due to oversights and misunderstandings. Nevertheless, the liability to accident will be minimized, if no loophole is left for any catastrophe except by unavertable causes or those due to casual careless errors and oversights of the employees entrusted with the care of moving trains. Until we have patent perfect human beings, the best of mortals are liable to err occasionally.

Reinforced Concrete Poles for Overhead Lines.

The rate at which the North American forests are receding and disappearing is a matter of universal concern. The effects of rapid tree-felling are varied and far-reaching. The immediate industrial effect is a steady rise in the price of lumber, which is not wholly a misfortunte, since it gives the most effective possible incentive to public investigation and attention. The more remote effects are climatic, influencing the rainfall and river floods. These, although eventually serious, come about so slowly as not to attract public attention. The diminution in the forest wealth of North America has already become sufficiently evident to involve Federal Government action in the protection of forest reserves, while associations of private citizens have also been formed in various states with a view to urging further forest protection and prevention of waste. One of the heavy drains upon the forests is the supply of wooden poles for new overhead electric lines, as well as for the maintenance of existing lines. The ordinary wooden telegraph poles have been so cheap and easily procured in the past, that it has not been considered worth while to apply a preservative treatment to them, although in Europe, where lumber is more costly, it has been for many years the practice to subject wooden poles to preservative processes. As time goes on, however, and lumber advances in price, it will become increasingly necessary either to increase the working life of wooden poles in North America, or else to find a commercial substitute for them in some other material.

On suggesting substitutes for wooden poles, steel poles are naturally first thought of. We have long been familiar with steel poles, of both the tubular and lattice frame varieties, in trolley construction for city streets. But lumber must still advance very much in price before it can be directly economical to use steel poles in preference to wooden poles on the score of first cost. Moreover, steel poles, unless kept in good surface condition by regular applications of paint, are apt to be no more durable than some kinds of wooden poles in the ordinary temperate zone climate. Rust will destroy the steel poles at the ground line as certainly as bacteria will destroy the wooden poles. In the case of long-distance transmission lines, however, it has already become economical to employ steel towers in place of ordinary wooden poles, and these towers can readily be afforded periodical inspection and protection; but the rank and file of poles for all classes of ordinary telegraph, telephone and electric-light service cannot expect such patronage. A more recent substitute for wood has, however, been offered by reinforced concrete, or concrete holding and supported by steel rods. On a large scale of construction, such reinforced concrete poles could be built less expensively than the ordinary steel poles. A great advantage of reinforced concrete is the wonderful fact that the steel it contains does not rust, but is indefinitely preserved. Three substances are needed, either simultaneously or successively, in the presence of steel, in order that oxidation may be effected and rust ensure, namely, moisture, air and carbonic acid. Moisture at least finds its way to the surface of the steel embedded in the concrete, but whether it be the absence of the other ingredients or not, experiment shows that rust does not form so long as the steel is covered by a concrete layer. It is evident, therefore, that reinforced concrete poles should last indefinitely without inspection or repainting. In fact, the well known difficulty with reinforced concrete is its relative indestructability. A wooden structure can be readily dismantled, or destroyed by fire, in case of need for removal, but reinforced concrete structures are not to be dismantled except by dynamite, and are almost as expensive to remove as to erect.

It will probably not pay in the near future to replace wooden poles by reinforced concrete poles merely on the score of purchasing cost. Even at the present rates of advance in price, the ordinary wooden pole is likely to remain the cheaper for a long time to come. But it is quite possible that taking only into account the value of security against sleet storms, the concrete pole can already compete. At the present time, the ordinary wooden telegraph pole has not a sufficient reserve strength for lateral wind stresses, when the wires which it may carry are loaded with frozen sleet to a diameter of an inch or more. On such happily rare occasions we know by sore experience that the ordinary wooden poles are liable to break by the dozen. It is practically impossible to secure the necessary factor of safety for such emergencies with ordinary wooden poles. But with reinforced concrete poles of somewhat larger diameter than the ordinary, such a factor of safety could be secured, without an unreasonable extra cost. Moreover, the concrete poles would be straighter and more sightly in appearance than the wooden poles, a distinct gain for the average landscape and for the people who have to live with it. It is interesting to notice that the Pennsylvania Railway Company has recently been experimenting with concrete poles and that the results of some of the experiments were announced at the Atlantic City convention of the Association of Railway Telegraph Superintendents last June, as reported in our issue of June 29.

Lightning Protectors for Transmission Lines.

A very common device for protecting transmission lines in Europe from lightning is the "horn" arrester. It is not often used in America, although it has found some favor in the West. It consists essentially of two stout copper wires supported opposite to each other, on insulators, in such a manner as to offer a suitable length of air-gap. Above the air-gap the two wires bend away from each other like a pair of ram's horns, so that at the top they spread apart for a considerable distance. If an arc forms at the gap it rises up the wires until it breaks of its own length. A suitable water resistance to

ground is usually connected to one horn, the other horn being connected to a high-tension line. The disadvantage of the device, which is very simple and inexpensive, is that the rupture of the arc may occur on the top of an alternating-current wave and set up oscillations in the line circuit, whereas an oil-switch, when operating properly, always suppresses an arc at or near the zero point of current, thereby avoiding the establishment of oscillations. Another plan which is extensively used in Europe, with considerable evidence of success, is the water-jet arrester. Each high-tension transmission line is connected to an insulated metallic cup. Into this cup a thin stream of plain water pours, in a column of suitable length, from a grounded reservoir above. It also empties by a similar stream into a similar grounded cup beneath. The jet orifices are so shaped, in every case, that splashing or interruption of the liquid column is avoided. The water supply is kept up continually and the total flow is quite small. The result is that each of the lines is permanently grounded through a pair of liquid columns of such dimensions that the waste of energy is insignificant; but no dangerous rise of pressure is allowed to form. A jet protector of this kind may be applied at each end of a long transmission line.

Another lightning protective device which has recently come into service in Central Europe for transmission lines of fairly high pressure is the condenser. Condensers with attached fuses were tried at one time in the United States on low-tension overhead lines as lightning arresters, with the object of absorbing sudden electric stresses; but since they usually became punctured in doing their duty, and thus went out of service when perhaps most needed, they were soon given up. As now built the condensers are glass tubes about an inch in diameter and a yard long, lined internally and externally with a chemically deposited metallic coating, and containing water in order to distribute readily their internally generated heat. A group of half a dozen such tubes forms a unit for connection, in parallel, to a single high-tension line, where the same enters a station and just before connection to a choking coil. It is claimed that these condensers are able to withstand very considerable surge pressures without being punctured, and that they greatly supplement the action of the usual choking coil arresters.

Prepayment Meters.

The discussion on "Prepayment Watt-Hour Meter" at the last Michigan Electric Association convention, seems to indicate that this instrument is about to enter on a new era of usefulness in central-station work. It has long been recognized that the prepayment meter, whereby the customer pays a little at a time by putting coins in the meter, meets a real need with respect to a certain class of customers. The main trouble has been the high price of prepayment meters in the past, such meters costing so much more than ordinary meters that central-station companies did not feel that they could install them very extensively among the numerous small customers where their use would be most desirable. The price difficulty seems to have been overcome recently, however. It is among the small users that prepayment meters will be used most extensively. Many people who live in a hand-to-mouth fashion will use electric light if they can pay for it a small amount at a time, as is allowed by the prepayment meter. Then, too, in apartment houses in large cities where tenants move frequently, the prepayment meter does away with all the waste of labor due to discontinuing service for an outgoing tenant and replacing it again for an incoming tenant. It also, to a certain extent, takes the place of a solicitor to look after incoming tenants, because with a prepayment meter already in place, and connected up, many a customer will drop coins in the slot and go ahead using the electric light, whereas he might do something else if it were a question of going to a distant office and signing an application. While there may be some loss due to tampering with meters in various ways by customers, it is not likely to be as large as the expense connected with the collection of a large number of small accounts from customers.

Competition in Electric Cooking.

In cities where gas is available for cooking it is not reasonable to expect that the wholesale introduction of complete electric cooking outfits will be easy. That many such outfits will be used in the future, even in spite of gas competition, is certain; but we doubt the wisdom of large investment in educational campaigns which have as their object the introduction of complete electric cooking outfits in cities where gas is available. Where gas is not available the case is entirely different. Electricity can compete with gasoline, coal and wood much better than with gas, because the difference in convenience and cleanliness between gas and electric cooking is not nearly so great as between the latter and cooking with gasoline or coal. Where gas is in common use for cooking, the wise policy for the central-station company appears to be not to make extravagant expenditures to educate people to use electric ranges to supplant gas ranges. It is much better, instead, to concentrate efforts on the introduction of certain devices against which gas cannot so successfully compete. It has already been well demonstrated that the electric flatiron is so far ahead of other irons that it is almost beyond competition. When we come to cooking devices, the first point of attack should be at the dining-room table, where there can be no real competition from other methods of heating. A great variety of electric cooking appliances can be used successfully on the dining-room table, but the one which is of most universal usefulness and the one which is likely to produce the best revenue when well introduced, is the chafing dish. There are dozens of every-day cooking operations that can be performed with a chafing dish, although that utensil at the present time has the reputation of being principally a show affair for the concoction of various indigestible dishes at irregular hours. We believe that if the central-station companies of the country during the next few months would concentrate their electric cooking campaigns on the chafing dish and educate the public to the general usefulness of that utensil, the returns would be much more immediate than by attempting to cover the whole field of electric cooking. A breakfast as elaborate as is desired by many a small family can be prepared with a chafing dish and a coffee percolator, and the variety of dishes need not be below average either.

Special Efforts for Residence Wiring.

We are pleased to note at the present time the increasing number of companies which are making special efforts to secure the wiring of old houses. We have persistently advocated strenuous work to build up central station residence load, because

this load when secured in large enough quantities is a better revenue producer per dollar invested than many more spectacular classes of lighting which have not nearly as good an aggregate load factor. We are also glad to see that some of these special efforts are being directed squarely at securing the smaller residences, which are really the best paying kind of residence customers. One plan that works well is to make a standing offer to wire for half a dozen lamps in a residence for a fixed amount, perhaps making this amount payable in installments. The cost of this small number of outlets does not frighten the customer as the complete wiring of his house might, and once the half dozen lamps are in use, it is only a question of time until the customer will gradually extend the wiring system to cover the whole house. It is an easy way of getting an entering wedge. Some companies are crediting each customer with a certain amount of the cost of his wiring on his monthly bills. In other words, the company makes the customer a present of a certain amount of energy consumed in order to secure him as a customer. The drawbacks to the plan are that it requires a customer to pay considerable cash down at the start, and that existing customers may be inclined to question the fairness of making new customers a present of energy, when old customers have to pay full, rates.

As to the plans for wiring residences and taking payment by installments covering one or two years, they are unquestionably good. If the company does not do construction work itself, arrangements can usually be made with local wiring contractors, the company carrying the accounts if necessary. One matter in this connection, however, does not appear to be receiving the attention it deserves, in spite of the fact that central-station men in general have been the first to recognize the necessity for good illuminating engineering. In connection with some of these special efforts and offers for residence wiring, it is frequently necessary and advisable for the company to have made up a large number of inexpensive and simple fixtures to install under these special contracts. It is right here that the central-station company has a splendid chance to recommend to the customer and to get installed fixtures and glassware which will not be the notorious complaint-producers that much of the junk installed to carry electric lamps has been in the past. The ultimate popularity of electric light in the small home is to depend entirely on the results obtained and the economy. It is therefore of very first importance that fixtures and glassware, even though they be cheap (and they need not be expensive), should be such as to give satisfactory results with reasonable lighting bills. The average fixture manufacturer knows and cares little about the results. The central station that depends on him for advice is lost. It is up to the central-station company to insist on proper design. We have known altogether too many companies who through oversight have not done this, even though the company had competent engineers in its employ.

ILLUMINATING ENGINEERING AS A BUSINESS-GETTER.

Much has been said about the necessity of illuminating engineering knowledge in the commercial department of central-station companies, but there has not as yet been enough detailed effort either to acquire this knowledge or to put it into practice. It is not to be expected that all the men in the commercial department of a central-station company should become proficient illuminating engineers on short notice. Neither is it expected that they should become motor experts in a short time. Nevertheless, as time goes on the successful central-station solicitor and commercial man must acquire a good knowledge of illuminating engineering and put it in practice if he is to be of the most use to himself and his company. In the larger companies probably many of the solicitors appreciate in a general way that it is a good thing for the company to have electric light employed in an efficient way by its customers. We doubt, however, whether many of them appreciate how immediately valuable illuminating engineering can be in getting contracts. In canvassing small houses along the company's lines (of which there are always many) it is worth much to the solicitor to be able to point to examples in the neighborhood where customers who have recently had their houses wired and the illumination planned according to sound principles, are getting very satisfactory light with very small monthly bills. A few examples of this kind in a neighborhood are apt to be worth more than all the other influences put together in getting this class of business. Take, for example, the house cited in the ELECTRICAL WORLD of Nov. 3, 1906, in "Electricty vs. Kerosene for Residence Lighting," where by virtue of economy in use and good illuminating engineering, the average bills for the first year amounted to only $1.28 per month, with $1 minimum bill and high rates. Practical examples of this kind can only be obtained and brought home to a neighborhood by a solicitor planning the lighting of a few houses in each neighborhood as an introduction. Then by keeping the matter well in hand, in order that extravagant installations may not be made, he may expect continued success in securing small residence lighting in his district.

But some central-station men will say that there is no profit in customers with such very small bills. This may be true, but that does not tell the whole story. The first year's consumption of a customer is seldom a true indication of the revenue to be expected from him. The first year he regards as a period of experiment with something which is likely to be very costly if wasted. After he finds that it will not bankrupt him, he gradually becomes more liberal in the use of energy and, perhaps, adds small heating appliances. It is to the new customers, however, that prospective customers are most likely to look for examples and to which the solicitor should direct attention, because they represent usually the greatest economy obtainable. Another way in which illuminating engineering is of immediate practical value is in retaining dissatisfied customers in both the down-town and residence districts. A customer retained is better than a new one gained. It is seldom that the improvement of a customer's installation means any permanent loss of income from him. In the case of stores, the cry is usually for more light for the same money, rather than for the same light for less money. Even where a solicitor by suggested changes reduces a merchant's lighting bills, it is usually the case that before long the customer will sign up contracts for additional business of the more profitable sort, such as window, sign and display lighting, so that in the end he will be spending more money with the company than he did at first and spending it more cheerfully. Then there is the question of competition with other illuminants. It goes without saying that the man who can make the most use of a given amount of electric light is the solicitor who can show the best results in the face of competition.

Empire State Gas and Electric Association.

During the present week the Empire State Gas & Electric Association has been holding its annual meeting in New York City. The regular sessions were held on Wednesday, Oct. 2, in the auditorium of the New York Edison Company, 44 West Twenty-Seventh Street, but the convention was preceded by a special joint meeting with the Street Railway Association of the State of New York at the concert hall of the Madison Square Garden, and many of the members stayed during the week to devote time to the interesting Electrical Show now being given in the Garden.

The joint meeting on Tuesday evening was of a notable character, and was well attended. Addresses were delivered by Hon. Frank W. Stevens, chairman of the Public Service Commission of the Second District on the work and policy of the body. Mr. Henry J. Pierce, president of the International Railway Company, Buffalo, spoke upon the electric railway situation of to-day. Dr. Alexander C. Humphreys, president of the Stevens Institute of Technology, discussed the control of gas companies by state commissions, and Mr. Everett W. Burdett, chairman of the Public Policy Committee of the National Electric Light Association, read a paper on public control from the corporate standpoint.

Commissioner Stevens, without mentioning the names of the companies, told of complaints of the inefficiency of some of the railroads, and expressed his horror at the numerous deaths and injuries caused by contributory negligence. He said that the commission will do all in its power to promote the efficiency of railroads, but that in doing so the legal rights of the corporations will be protected. The commissioner said that it was time that the power of the State was invoked to remedy certain evils, and the Public Service Commission deserved to have the support of the corporations. "The companies are entitled to a fair compensation; the public will pay a liberal price for efficient service, but not for poor service. We will do our duty to the public, but I assure you that it will be done without any theatrical effects. There will be no attempt to coerce the corporations or hamper trade."

In his address Dr. Humphreys reviewed the course of recent agitation, investigation and legislation directed at corporations with such indiscriminate zeal and expressed his belief that real reforms would be secured, although labor and capital were both likely to suffer from the loss of credit and confidence. "While a panic has thus far been averted, properties have been tremendously depreciated, and innocent investors have been injured." Moreover, many people had overlooked the evils involved in the creation of powers of inquisition and control, and the centralizing of power in bureaucracies. He continued as follows:

As we are gathered here to listen not only to generalities but to that which possibly may be more directly helpful, I will take occasion now to urge the gas men of New York State, particularly as represented in the Empire State Association, to co-operate with other bodies in the efforts now being made to develop a uniform system of accounts and records, and, in that connection, to do everything in their power to co-operate with and secure the co-operation of the two New York State commissions. It is well that the Empire State Association has appointed a committee on uniform accounting, but we do not want this uniformity confined to one state. We should have one system for all the companies of the United States and then we may hope that the state commissions will find that they can secure the maximum of efficiency in this regard by taking advantage of the system so developed.

Many people speak quite glibly as to the possibility of developing a uniform system of accounts. Those who start out to develop such a system, thinking they have an easy problem to solve, are from the first doomed to failure and disappointment. I have had perhaps an unusual experience in this direction and I do not hesitate to say that let the companies working under a uniform system be absolutely under one government, let that control be concentrated even in one man, let the system be devised with consummate skill and maintained and operated with unflagging zeal, discretion and loyalty, it will still be difficult and, perhaps, impossible to have the accounts so that they are at once absolutely comparable. All the variations and the conditions cannot be covered by one system of accounts, records and instructions, and even if they could be, unavoidable variations as to the application of the instructions would be developed through the personal equation. But let us do all in our power as public service corporation managers and as good citizens to keep this variation down to a minimum.

One very disturbing element in the uniformity of accounts, and especially the records of costs, is the, in some ways, intangible and, in other ways, very real element of depreciation. Unless our commissions can come to a realizing sense of the difficulties they have to meet in connection with this matter of uniformity of accounts and records, they too are doomed to failure, at least to the extent of making unjust decisions.

For many years the gas companies of the State of Massachusetts have been governed by a commission, and, in some ways, well governed. In other ways, injustices have been done to the stockholders and these injustices have been in part due to the accounts as kept by the companies, and in part to the way in which the returns have been required and treated by the commission. One point certainly has been demonstrated, namely, that the returns as published are not tabulated according to a uniform system, in other words, that you cannot take the published records of the Massachusetts commission and make fair comparisons on the basis of the data so furnished.

Here comes in an injustice, not only to the companies of Massachusetts, but still more to the companies outside of Massachusetts, for they have no power of correction. Those who are not fully informed take it for granted, because they find certain data tabulated apparently according to a uniform system, that all the figures in a certain column must represent the same thing for each company represented. In many cases this is far from being the truth, as I have shown in my New England Association paper referred to and will show in the paper which I am about to read before the American Gas Institute.

Therefore, in New York State, in endeavoring to co-operate with and secure the co-operation of our new gas commissions, we have to consider not only our duty to our own companies, but we have to consider our duty to the other companies throughout the United States, for throughout the United States no doubt will be published the results of our workings, and, unless the accounts are correctly kept according to a uniform method, correctly reported and correctly tabulated, unwarranted and misleading comparisons will be made.

Mr. E. W. Burdett discussed public control from the corporate standpoint under three heads: past, present and future. He showed how eager the public had been to foster modern corporate utilities into existence until they had become commonplace adjuncts of daily life. The clamor for their introduction had become that for regulation, and railroad rate legislation had been the first outbreak. But here at once the interposition of the Federal judiciary had withstood spoliation.

The Supreme Court, while affirming the right and exclusive authority of state legislature to regulate rates and fix maximum charges, has also subjected the reasonableness of legislative action in this respect to the test of judicial inquiry. It has insisted upon rates which are sufficient alike to give a reasonable return upon a reasonable investment and at the same time be inherently fair and reasonable to the public. While insisting that ordinarily a corporation is entitled to some profit upon its enterprise, the court has not as yet undertaken to say what that profit shall be, except in one case (192 U. S., 201:—1903) that the rates of a water company may be lawfully reduced by legislative action to a point where the business will yield only 6 per cent upon the fair value of the investment.

It seems natural and appropriate to suggest at this point that one of the most important functions of the newly created Public Service Commission of the State of New York may be to determine, in the first instance, what a reasonable return is upon capital invested in the public service corporations which are under

their supervision and control; and it is at least reasonable to indulge the hope that they will not undertake to limit that return within the narrow margin which has been accepted by the court as sufficient in the case of such a comparatively simple and well-established enterprise as that of the supply of water. There is very little analogy between the cases. If the return on capital invested in what can be properly described as essentially experimental industries, such as street railway and electric enterprises, is to be confined to any figure as 6 per cent, it will, in my judgment, be a sorry day, not only for those who have their money at hazard in these enterprises, but for the public at large whose interest lies in their proper development and extension.

As conservative a man as President Eliot, of Harvard University, has recently said: "In such enterprises there are often heavy risks . . . Hence men will not undertake them for the ordinary return on safe investments. They must be induced to venture their capital and their capacity by a prospect of unusual returns." ("The Ethics of Corporate Management," Chicago, March 10, 1906.)

So far as I know, public service corporations other than steam railroads have in but rare instances been made the subject of state regulation or control, by special tribunals created for the purpose. They have ordinarily been left at the mercy or state legislatures or, worse yet, of the various municipal authorities where they operate. They have thus been forced more or less into state and local politics, a course justified, if at all, by the dictates of "the first law of nature"—that of self-defense. But in 1894 the State of Massachusetts entered upon a more enlightened experiment in public regulation and control of quasi-public enterprises; and since that time the capitalization, debt, rates, service and general conduct of the public service corporations of Massachusetts have been within the control and regulation of public bodies created for the purpose. What has been the result of this experiment can, I think, be fairly gathered from the fact, which I think is a fact, that those concerned with corporate, as well as those concerned with public interests in Massachusetts, will be found to be in practical agreement that the laws referred to and their administration have been fairly satisfactory, and that no considerable force could now be mustered from any quarter to repeal them.

The one primal defect in the laws of Massachusetts regulating and limiting the stock and bond issues of its public service corporations—an error which ought to be avoided in the administration of the law in New York—lies in the failure to discriminate between new enterprises or hazardous extensions of old enterprises, on the one hand, and well-established industries on the other. Admitting that the securities of the latter can properly be limited to amounts sufficient only to cover the reasonable expense of ordinary additions to plant, and the returns upon them to the going rates of interest or profit legitimate in established business of like character, the reasonableness of the rule disappears when applied to extensions of unusual character or into fields of doubtful profit, and particularly to cases of incursions by new enterprises into hitherto unexploited fields. The pioneer who first dares to explore hitherto unexploited territory, or the inventor who is willing to increase the usefulness of his enterprise by extending it into channels of doubtful profit, should not be treated in the matter of initial securities or the returns upon them with the same strictness as the conservative investor in an established business. To quote President Eliot again: "There is much to be said on behalf of the proposition that there shall be no water in the stock of public service corporations; yet if this principle had been applied to all street railway and lighting companies during the past 35 years, the public would have waited long for facilities which they have greatly enjoyed and profited by."

The great authority of the Supreme Court of the United States, as expressed in the case of Handley vs. Stutz, 139 U. S., 417, stands for substantially the same proposition.

The present attitude of New York corporations is one induced by necessity. It is a condition and not a theory which confronts them. Whatever may have been their former attitude is immaterial; at present they have no choice except to submit themselves to a control more drastic and complete than any heretofore known in this country. They are necessarily on their good behavior. They may not like the commissions, but they cannot afford to make faces at them.

What, then, shall the future attitude of the corporations be toward public supervision and control? In my opinion it should be a friendly, and not a hostile, attitude. If I were in charge of a large corporation in the State of New York I would not, if I could, repeal the existing law, though I confess I should favor some radical amendments of it. The greatest objection to it is, as I have said, that everything depends upon the men who administer it. It does not announce the principles upon which they shall act, nor undertake to outline the policies which they shall adopt. Assuming, however—as I am glad to think I have a right to assume—the high character and capacity of these gentlemen, and their disinterested and patriotic purpose to administer the law in the interest of invested capital, as well as of the public, I believe that a great opportunity lies before the corporations of this state to so influence the opinions of the commissioners that the highest good to all concerned will result from their construction and administration of the law. But this cannot be successfully done if gone at in a narrow, partisan, or altogether selfish manner. The settling of the questions which will arise before the commission will involve great principles of law and of public policy, alike of interest to the community and of vital importance to the companies. All fears of adverse results are dissipated if one entertains the conviction, as I have no doubt the body of the commissioners do, that the true interests of both the corporations and the public are substantially the same; that the necessity for injustice to either in order that justice may be done to the others does not exist. It is not for the interest of the public that the corporations shall be crippled in their activities or unreasonably limited in their profits; and, on the other hand, it is not in the interests of the corporations that the public shall be subjected to exorbitant rates, poor service or contemptuous treatment. Time does not permit, and perhaps this would not be the proper occasion, to undertake to develop and demonstrate the truth of these general propositions, but reliance may well be put upon the fact, which I think cannot be successfully disputed, that both in this country and abroad the public are best served where the corporations are most prosperous, and the corporations are most prosperous where the public is best served.

This state of things will, in my judgment, be greatly promoted in the future by the application of a principle, or, perhaps, it should hardly be called more than a device, which, while successfully applied abroad, has not as yet had much attention in this country, to wit, the so-called "sliding scale," under which, when a proper relation has once been established between a company and its customers, the profits of one are made directly dependent upon the economies to the other.

Mr. Henry J. Pierce in dealing with the electric railway situation pointed out that the public was ever demanding greater facilities, all of which meant increased expense, while at the same time the authorities were constantly increasing taxation. This meant one of four things—poorer service; price of labor or material reduced; rate of fare increased, or taxation reduced. Private or industrial plants could be closed down or limited in dull times, but a public service corporation is required to keep working up to the limit. There was no practicable chance to increase fares, but with lesser burdens in taxation, street railways could do something to meet the demands on them for constant improvement in the service. For himself and fellow managers of street railways, he could promise cheerful acceptance of the new law, but the acts of the commissions must not all tend one way and discriminate against the corporations, which to-day simply could not raise money for improvements because of hostile legislation and regulation. He closed with an earnest plea for a reduction in the burdens of taxation in this time of vast demands and colossal requirements.

Electric Light Companies at the New York Electrical Show.

The Electrical Show which opened in Madison Square Garden, New York City, on Sept. 30, and which will continue until Oct. 9, differs greatly from previous electrical shows held in New York in that the local electric light companies are pre-eminent among the exhibitors. The New York Edison Company, the Edison Electric Illuminating Company of Brooklyn and the United Electric Light & Power Company of New York, are all conducting a campaign of education for the benefit of their respective patrons and for the general public. The central-station feature predominates and this fact is blazed from the Madison Square Garden tower by large electric signs with the names of the three companies.

Each of the companies, besides making an extensive exhibit, has given to its patrons or placed at their disposal tickets of admission, of which privilege most customers have availed themselves. Nor has frugality prevailed. Realizing that only by an appropriate setting can the advantages of electricity be best presented to the lay mind the proper environment has been provided and the sum expended by the three lighting companies to secure it aggregates not less than $60,000. The lighting companies have also as if by common consent, specialized, so to speak, in their displays. The New York Edison Company makes the industrial application of electricity the keynote of its exhibit; the Edison Electric Illuminating Company of Brooklyn, shows its many domestic applications, and the United Electric Light & Power Company features the various uses both industrial and domestic to which alternating current may be applied.

FIG. 1.—GENERAL VIEW OF THE ELECTRICAL SHOW IN MADISON SQUARE GARDEN.

The booth of the New York Edison Company is in the center of the arena, and is shown herewith. Everything in it is in actual operation. In one corner are shown two hydraulic pumps, one direct-connected to a 4-hp motor, and the other belt-driven by a 10-hp motor. Adjoining these are a small circular saw, hacksaw, bench-drill, and a line of motor-driven buffing machines, grinders and blowers. In the opposite corner are three pieces of apparatus of interest to printers; a sweating-on machine equipped with an electric heater, a motor-driven proofing press, and a Jordan job press. On a table beneath the dome are various motor-driven meat-choppers, coffee-grinders, buffers, vibrators, etc., and two oscillating fan-motors on ornamental pedestals. In the rear corner of the booth is a line of electric breast drills, grinders and hoists, and immediately at the left is a motor-driven dough mixer, and also a floor-surfacing machine and an electric potato-peeler. Automatic air pumps, letter-copying machines, vibrators, and a large motor-driven turbine cleaner complete the exhibit. Needless to state the booth is attractively decorated and illuminated and the New York Edison's well gotten-up literature is distributed.

Blazoned in letters 12 ft. high and 93 ft. long, the word Brooklyn stands out in sharp contrast at the west end of the spacious Garden. This sign is over the booth of the Edison Electric Illuminating Company of Brooklyn, whose display is one of the features of the show. The company shows a complete home of seven rooms, with doorways leading from one to the other, started with an office or reception room. In this office is the registering staff for visitors who call. The row of seven rooms is open to public view from the outside, but entrance is only through the office. Twelve courteous lady attendants and demonstrators, attired in pink, accompany visitors through the apartment and explain the various devices shown.

The aim of the company is to place before the public in concrete form an illustration of the advantages of an electric service in the home—the "tone," conveniences and comforts it adds to the household.

A feature of the first room is the telharmonic. Here are also found an electric cigar lighter, an electric fountain, and an electrically driven sewing machine. Next to the office is the bed chamber tastefully fitted and decorated in Nile green. Here are shown such electrical appliances as a hot-water bottle, bed-warming pad, curling iron, foot warmer, nursery milk-warmer and a system of lighting which is very convenient. Adjoining the bedroom is the drawing room. An electric grate lends a homelike appearance to the room. In one corner is a piano with a Tel-electric attachment. A neat little hall leads from the parlor to the dining room and shows what can be

done in the lighting of a house. By simply pressing a button all the lamps may be switched into circuit, or a solitary lamp left lighted for the late comer. An electric heater is also shown in the hall. A Flemish dining room adjoins the drawing room. Here is to be found a chafing dish, coffee percolator, hot-water heater, warming pan, vacuum carpet sweeper and other articles of a well-appointed dining room, all operated by electricity. In the kitchen are shown a dish-washing machine with a rotary action and an additional machine for rinsing. There is an electric stove with four heaters and an oven, and an electrically operated hot-water heater. Other useful articles are a coffee

FIG. 2.—EXHIBIT OF THE NEW YORK EDISON COMPANY.

grinder, soup kettle, deep fat kettle, broiler and a ventilating fan. In the laundry there is to be found an ice machine and refrigerator, and also an electric washing machine, consisting of a washtub and wringer. The color display in the decorating of the various rooms is most artistic and the furnishings are in keeping with the decorations.

The United Electric Light & Power Company occupies the four spaces on the north side of the center aisle as one enters the Garden. The booth proper is divided into four parts, showing lighting, heating, motor and industrial exhibits.

In the lighting part of the booth are shown various types of alternating-current carbon, metallized-filament, tantalum, tung-

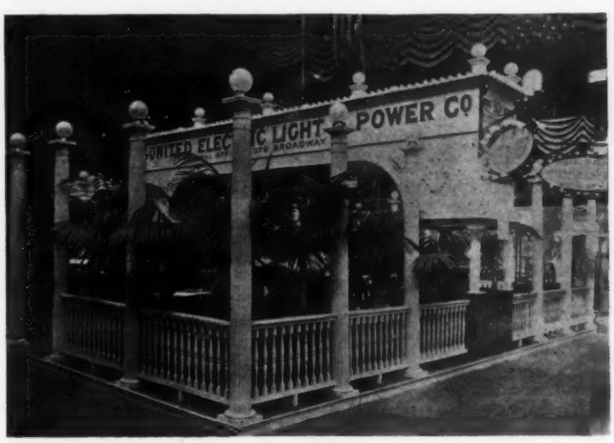


FIG. 3.—BOOTH OF THE UNITED ELECTRIC LIGHT & POWER COMPANY.

sten and Nernst lamps and various styles of electroliers and portables. A particularly beautiful portable is that representing a water fountain.

In the electric-heating part of the exhibit an electrical range is shown in operation as well as various modern household heating appliances, such as irons, hot-water bottles, radiators and curling irons.

In the power exhibit are motors attached to sewing machines. Electrical massage machines and buffing machines are shown, as well as a number of types of single, two and three-phase motors connected to centrifugal and plunger pumps. A Waite & Bartlett electrical massage machine is also shown for the first time.

Electric fountains are shown in operation in the arches of the exhibit. In these the lamp is hidden under vari-colored glass, over which the water is caused to play by means of a small motor-driven pump, enclosed in the lamp stand. By this means the same water is used over and over again.

In the industrial part of the exhibit two applications of alternating current are predominant. One feature brings to notice the extended use of alternating current in the plant of the National Biscuit Company at Tenth Avenue and Fifteenth Street, New York. This exhibit and the one of the newest machine exhibited at the Garden, that of an automatic spot welding machine, manufactured by the Universal Electric Welding Company, attract much attention. This machine makes 85 welds per minute, and is used for attaching handles to can covers, plates, knives and garden implements. Souvenirs showing this electric welding are distributed among the patrons of the booth.

The arch covering the booth contains at its top 10 tungsten lamps fitted with 8-in. Holophane globes. Over the top of the entire booth is a huge electric sign, 8 ft. high and 32 ft. long, containing 519 lamps, reading "The United Electric Light & Power Company, 1170 Broadway, Alternating Current." The booth proper is banked with palms, and these, with the other furnishings, are very pleasing to the eye. In addition to the 8-in. Holophane globes at the top of the arch, the booth is surrounded by 20 pillars, on the top of which are 8-in. sand-blasted globes. Uniformed attendants take care of the advertising matter of the company and the booth also contains a business place in charge of a representative of the sales department, where bills are received and contracts can be signed.

Fall Meeting of the American Electrochemical Society.

The fall meeting of the American Electrochemical Society will be held at the Chemists' Club, 108 West Fifty-Fifth Street, New York, Thursday, Friday and Saturday, Oct. 17-19. There will also be a reception at the club on Thursday evening and a banquet on Friday evening at the Liederkranz Club. An excursion has been arranged on Friday afternoon to the laboratory of Thomas A. Edison, and on Saturday afternoon several power plants in New York and vicinity will be visited by different parties. An excursion to the large electrolytic copper refinery at Chrome, N. J., has been arranged for Saturday afternoon. A final entertainment will be tendered to the members in the form of a "smoker" by the Chemists' Club on Saturday evening.

On Thursday evening Dr. George F. Kunz will deliver a lecture on "The Diamond and Moissanite," following which Mr. E. G. Acheson will lecture on "Defloculated Graphite" with experiments. The meeting of Friday morning, to be held at the Chemists' Club, will be devoted to the subject of "Electrometallurgy of Iron and Steel." On Saturday there will be a morning session at Columbia University for the reading and discussion of papers. Following is the programme of papers:

Friday Morning Session:

"On the Electrothermic Reduction of Iron Ores," by Messrs. Albert E. Greene and Frank S. MacGregor. "The Electric Furnace Experiments for the Production of Pig Iron at Sault Ste. Marie," by Dr. Joseph W. Richards. "Electric Furnace Experiments," by Dr. H. N. Potter. "Discussion of Moissan's Experiments on the Boiling Points of the Metals," by Dr. O. P. Watts. "The Electrometallurgy of Zinc," by M. Gustave Gin. "A New Application of Chlorine in Metallurgy," by Mr. C. E. Baker. "The Heat Conductivity of Carbon," by Mr. F. A. J. FitzGerald. "Granular Carbon Resistors," by Prof. S. A. Tucker.

Saturday Morning Session:

"Physico-chemical Notes on the Aluminates of Soda," by Mr. P. B. Sadtler. "Action of Ammonium Persulphates on Metals," by Mr. J. W. Turrentine. "Note on the Use of the Capillary Electrometer for Alternating Voltages," by Mr. M. G. Floyd. "Electroscopic Determination of Radium in Some Tufa at Hot Springs, Arkansas," by Dr. Herman Schlundt. "Electrolytic Separation of Silver and Copper," by Mr. H. W. Gillett. "Electrolytic Determination of Minute Quantities of Copper," by Mr. E. E. Free. "Electrolytic Reduction of Nitric Acid," by Dr. H. E. Patten. "Electrochemical Methods for the Qualitative and Quantitative Determination of Free Silicon in the Pressure of Silica, Silicates, Oxides, Free Carbon and Carborundum," by Mr. W. R. Mott. "On the Nature of Electrolytic Conductors," by Dr. L. Kahlenberg. "The Electrolytic Theory of the Corrosion of Iron," by Dr. A. S. Cushman, with demonstrations. "On the Treatment of Storage Battery Elements Before Putting them Out of Commission," by Prof. O. W. Brown. "A Further Study of Concentration Cells," by Dr. Henry S. Carhart.

Prof. S. A. Tucker, Columbia University, is chairman of the New York committee of the society, and Mr. Alois von Isakovics, Monticello, N. Y., is the local secretary. During the meeting there will be an exhibition of some new electrochemical product apparatus.

CURRENT NEWS AND NOTES.

STREET RAILWAY CONVENTION.—At the Atlantic City street railway convention, Mr. W. J. Clark has promised to read a paper on the important subject of "Municipal Ownership in Great Britain and in the United States." For a long time past he has made a special expert study of this great modern problem and its data.

PUBLIC POLICY.—The report of the Public Policy Committee of the National Electric Light Association, together with all the reports of that committee's sub-committees, is now available in printed form, and in accordance with the statement recently made in the monthly bulletin of the association, extra copies of this can be obtained from the association at the price of $1 each.

THE TELEGRAPH STRIKE still continues, but no further bodies of men have been called out, and in Canada there has been a wholesale return of the operators to such positions as might be open to them in the Great Northwestern System, owned by the Western Union. A petition for better service has been made by some 50 members of the Produce Exchange in New York City. The exchange has over 1000 members. An investigation of the alleged delays is being made.

NEW YORK INTERSTATE TELEPHONE.—Last week at Syracuse, the following officers were elected at the meeting of the New York Interstate Telephone Association: President, J. H. Griswold; vice-president, Wilbur H. Johnson, Buffalo; secretary, R. Max Eaton, Niagara Falls; treasurer, George R. Fuller, Rochester; executive committee, B. T. Bellander, George B. Wright, Williamsport; J. H. Griswold, Albany; Wilbur H. Johnson, Buffalo, and C. H. Poole, Utica. The members of the executive committee were elected as delegates to the convention of the National Telephone Association which will be held in Chicago in December.

AN EDISON ENGINEERING COMMISSION has been appointed by the executives of the Edison Illuminating Companies of New York, Chicago, Boston, Philadelphia and Brooklyn, to make a thorough investigation and to report with recommendations on the design, construction and operation of the generating, transmission and distribution systems of each of the five companies. This commission is composed of three engineers from each company, and is organized as follows: W. F. Wells, of Brooklyn, chairman; P. Junkersfeld, of Chicago, secretary; W. C. L. Eglin, of Philadelphia, treasurer; L. L. Elden, of Boston, chairman, committee on operation; P. Torchio, of New York, chairman, committee on design, and W. C. L. Eglin, of Philadelphia, chairman, committee on purchased apparatus.

A. I. E. E. MEETING.—The next regular meeting of the institute will be held in the Engineering Societies Building, New York City, on Friday, Oct. 11, at 8:15 p. m., when a paper will be read on "The Grounded Neutral, With and Without Series Resistance, in High-Tension Systems," by Paul M. Lincoln, engineer of power division of the Westinghouse Electric & Manufacturing Company. Experience papers will be presented on the same subject by F. G. Clark, superintendent of power station of the Pennsylvania Tunnel & Terminal Railroad Company, and George I. Rhodes, assistant-engineer of the Interborough Rapid Transit Company of New York. The papers and discussions cover advantages and disadvantages of the grounded connection under various conditions, more particularly the possibility of cutting out faulty feeders without interrupting the service. The function of the series resistance in the ground connection will be considered both theoretically and practically.

DR. STEINMETZ'S LECTURES ON LIGHT AND ILLUMINATION.—The Polytechnic Institute of Brooklyn offers the following interesting course of lectures on radiation, light and illumination by Dr. Charles Proteus Steinmetz. The lectures will be given in the evening and will be illustrated by occasional experiments. The dates and subjects are as follows: Nov. 7, Radiation as a Form of Energy; Physical and Chemical Effects of Radiation; Nov. 21, Physiological Effects of Radiation; Visible, Infra-red, Ultra-violet and X-radiation; Dec. 12, Black-body, Gray-body and Colored-body Radiation; Jan. 9, Selective Radiation of Gases and Vapors, Arcs and Discontinuous Discharge; Jan. 23, Efficiency of Transformation into Radiant Energy; Feb. 13, Measurement of Radiation and Photometry; Feb. 27, Commercial Illuminants, Flames, Incandescent Lamps and Arc Lamps; March 12, Illumination and Illuminating Engineering.

TELEPHONE SIGNAL SERVICE.—Something unique in navigation aids will be the telephonic marine signal service which is now being established on the St. Lawrence River between Quebec and Montreal, and which will be in use early in October. The service is to provide for a system of communication between ships and shore, and will enable the owners and agents to know of the progress of ships between these two cities. It will also enable the captains of vessels to learn of the condition of affairs in the river and to avoid any unusual or unexpected danger. There is no such service in existence anywhere else in the world, and, with no experience to be guided by, the engineers were obliged to originate a service. At each station will be erected a mast 65 ft. high with a cross-spar 25 ft. in length, placed about 20 ft. from the top of the mast. From this cross-spar signals will be displayed, one side for down-stream and the other for up. When signals are to be displayed, an ensign will be flown from the masthead. At night a white light at the masthead will call attention to signals. A set of flag signals has been prepared for day use, and a set of lamps arranged for use after dark. One signal will enable vessels which desire to pass through Quebec to take on a pilot without carrying on the continuous whistling performance which now annoys people in Quebec. The various messages received and to be sent will be dispatched from one station to another by telephone to either Montreal or Quebec, and then to the agents of the ships interested.

ENGINEERING AT UNIVERSITY OF MICHIGAN.—Nearly 500 freshmen engineers have been enrolled this year at the University of Michigan.

HARVARD ENGINEERING COURSES.—The enrollment in the Harvard Graduate School of Applied Science, which now enters its second year, is more than double that of last year. A degree, such as A. B. or B. S., is required for admission to this school, but engineering is also taught at Harvard as an undergraduate study.

THE MAILING LIST.—The Technical Publicity Association devoted the first meeting of the year, Sept. 26, to the consideration of "The Mailing List." N. W. Gage of the "Buyers' Reference" and Burdette Phillips, of the "Central Station List" and "Electric Railway Directory," addressed the association, and a long discussion followed in which various members told their experiences in making and using mailing lists, and in some instances compared this form of advertising with trade magazine advertising. It was decided to take up other phases of this broad subject at the October meeting of the association.

WIRELESS ENERGY TRANSMISSION.—A special cable dispatch from Paris of Sept. 26 says: "A young Lyons scientist asserts that he has discovered a means of transmitting electrical energy without wires. Experiments are now proceeding in the grounds of the Château du Cret, belonging to a Lyons manufacturer named Auguste Villy. A miniature car, running on rails, was recently propelled a distance of 200 yds. by means of energy from an electric transmitter. Details of the process are withheld for the present. Patents were taken out in August. A syndicate of bankers has been formed to work the invention."

INDUSTRIAL EDUCATION.—As a preliminary to its gathering of manufacturers, trades-unionists and educators in Chicago on Dec. 5 to discuss industrial education, the National Society for the Promotion of Industrial Education has sought the views of 300 manufacturers and labor men. Of the early replies received a large majority of both classes favored strongly the introduction of public trade and technical instruction. Bulletin No. 3 of the society, which can be obtained free on application to C. R. Richards, secretary, care of Teachers' College, New York, gives the views of some of the manufacturers and labor men.

FIVE THOUSAND MEMBERS.—The American Institute of Electrical Engineers has just passed the five thousand member mark, and bids fair to gain at a rate of over one thousand a year. This does not include students. The past year has been one of great success and usefulness in every direction, and Dr. Samuel Sheldon, as president, has shown remarkable energy and executive ability, winning commendation in every quarter. In fact his work as an administrator has attracted such general attention, as to lead to his recommendation for the presidency of the Massachusetts Institute of Technology, an institution for which his high technical training and wide experience as a teacher also give him notable qualifications. In short it may truly be said that Dr. Sheldon leaves the Institute presidential chair with a well-deserved and greatly enhanced reputation.

WIRELESS TELEGRAPHY IN FRANCE.—Consul-General Skinner, of Marseilles, reports the following information, received from the French Director of Posts and Telegraphs, concerning government wireless telegraph stations: "At present there are two stations for wireless telegraphy, one at Ouessant and one at Porquerolles. These two stations are prepared to handle private messages, to which may be added the station at Dieppe, which belongs to the Western Railway Company. Two other stations are about to be opened, one at Saintes-Maries-de-la-Mer (near Marseille) and the other in the environs of Algiers. It has been determined, according to an agreement reached between the interested departments of the Government, to establish stations at Boulogne, Havre, St. Nazaire, La Coubre, Nice and Cape Corsica. This programme has been established tentatively and is susceptible of modifications."

RADIUM IN ALPS.—A recent investigator has found numerous traces of radium around the new Simplon Tunnel, and attributes to it the extreme heat noted there. This may be a new source of supply. In the current *Harper's Weekly* Dr. Truman Abbe, in an article entitled "The Most Costly Thing in the World," says as to the difficulty of procuring radium: "Some idea of the difficulties in the way of extracting radium from the pitchblend waste may be appreciated when we learn that pitchblend, the mineral that is richest in radium, contains but one-millionth part of 1 per cent of radium, less than the proportion of gold in ocean water. We would think it a pretty thankless task to mine gold, or extract it, from sea water; but the work would be far easier, and we should get more gold from a cubic yard of sea water than we would radium from a ton of pitchblend. Perhaps, then, it will not be hard to appreciate how little radium there is in the world—less than twenty grains, certainly not half a teaspoonful of pure radium bromide. A grain of gold can be had for 5 cents or less. Diamonds are worth by weight, much more, perhaps $10 a grain, but the cost of radium is truly fabulous—$7,200 for a single grain."

MEETING OF THE A. S. M. E.—The American Society of Mechanical Engineers will hold the first monthly meeting this fall on Tuesday evening, Oct. 8, at 7:45, in the main auditorium of the Engineering Societies Building, at 29 West Thirty-Ninth Street, New York. The subject of this meeting—Industrial Education—is one in which manufacturers are very much interested. The college technical courses and the student apprenticeship courses will be discussed at length by men who have been in charge of theoretical and practical institutions. Prof. John Price Jackson has written a paper on the college technical courses and apprenticeship courses offered by manufacturing establishments. He gives data in the form of letters from several of the largest manufacturing establishments in America, in which they outline the courses offered by the factories, and explains the matter of conducting the same. Dr. Henry S. Pritchett, president of the Carnegie Foundation and president of the Society for the Promotion of Industrial Education, and Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology and president of the Society for Promotion of Engineering Education, will deliver short addresses on the subjects allied to their societies. Manufacturers have been invited to speak informally of their experiences, and altogether it is expected that the meeting will prove interesting and instructive.

INTERPLANETARY SPACE has been the subject of a good many theories, speculations, inquiries and bold statements. At the meeting in Dresden, Germany, on Sept. 25, of the Congress of German scientists a remarkable statement was made by Prof. Hergesell, of Strassburg University. He says that atmosphere at high altitudes is coldest over the equator and warmest above the poles. This surprising result, he explains, was determined by balloon ascents made last July in various latitudes. The observations, which were taken with automatic instruments attached to unmanned balloons, have not yet been worked out in detail, but Prof. Hergesell finds his conclusions abundantly proved through the data collected. Balloons which reached altitudes of 11 to 12½ miles in the tropics were found to have registered about 148 deg. below zero, F., while in the latitude of Central Europe the temperature was only 76 to 85 below zero at the same heights. Another fact established by these balloon ascents is that the greatest cold of the upper atmosphere is reached at heights from 6 to 6¾ miles. Above that height, contrary to the assumption of scientists hitherto, the air actually grows warmer. This warmer stratum of air is highest at the equator and lowest at the poles, where it is estimated to begin at about 4⅛ miles. Prof. Hergesell concludes that the atmospheric conditions affecting the weather do not reach higher than 7 miles.

RULES FOR UTILITIES.—The up-state section of the Public Service Commission has, like that for New York City, drawn up a series of rules and regulations governing the nature of franchises, issuance of bonds, etc. Copies are furnished from the office in Albany.

DEVELOPING PEAT.—A meeting will be held at the Jamestown Exposition from Oct. 15 to 18 to form an organization to be known as the American Peat Association. The object of the association is to utilize the many acres of swamp land throughout the country, at the same time reclaiming it for agricultural and other uses, and to provide a cheap fuel. It is also proposed to demonstrate the manufacture of by-products from peat.

ACCIDENTS IN AMERICA.—At Berlin, on Sept. 28, Dr. William H. Tolman, social economist, of New York City, read a paper before the International Congress of Hygiene and Demography on "Industrial, Sanitary and Safety Devices." He described the work of the council of the editors of the American scientific and industrial journals to reduce the number of casualties in the industrial army. In America, Mr. Tolman asserted, these were continuously as great as were the casualties during the American Civil War and the Franco-Prussian War.

A NEW ELEMENT.—Mr. Bertram B. Boltwood, of Sloane Laboratory, Yale University, writes to the editor of *Nature*, under date of Sept. 9, that from various experiments conducted in the Sloane Laboratory, he thinks there is good cause for believing that the uranium minerals contain an element emitting "alpha" rays which is different from other elements that have been identified and which produces no emanation. The new element resembles thorium in its chemical properties. "The activity of this element," continues Mr. Boltwood, "appears to be about the same as that of radium itself. It is without doubt a product of uranium and is probably the immediate parent of radium."

MAINE WATER POWERS.—Kennebec River and its important tributaries furnish some of the best water powers of the country, besides affording many excellent sites for further development and the welfare of the whole state of Maine is involved in the wise extension of the use of this river and its branches for water power, for log driving and lumbering, and for municipal and other purposes. To meet the constant demand for information in regard to the hydraulics of this great drainage basin, the United States Geological Survey has just issued, as Water Supply Paper No. 198, a report embodying all available data in regard to the flow of the streams and the possibilities of regulating that flow by means of storage, opportunities for which are exceptionally good.

DIRECT HAVANA CABLE.—It is announced that the Commercial Cable Company's new cable service, giving direct communication between this city and Havana, is now expected to be in operation by Oct. 15. The cable steamer *Silvertown*, owned by the India Rubber, Gutta Percha & Telegraph Works, of London, England, the concern which obtained the contract for manufacturing and laying the New York-Havana submarine cable, is due at Havana about this time and promptly after her arrival there will begin the work of laying the cable from that port to New York. This task is expected to take only about two weeks. The new cable, which will be approximately 1300 miles in length, will be the only all sea cable line between New York City and Havana.

LONDON SHOW-WINDOW LIGHTING.—According to our English contemporary, *Electrical Times*, London shopkeepers are learning to appreciate the advertising value of the electric light in shop windows after closing hours. Referring to one prominent example, it says: "On a fine evening the crowd of well-dressed people gathered round these windows is considerable. Of course the exhibition is ten times as attractive by night as it is by day; that is the first point to recognize. The educational work of the window continues long after the business of the counters has come to an end, and the function of the window is a vastly important one. The sex that inspects the windows for ten days as the preliminary of spending money for ten minutes, will find that illuminated windows shorten the intervals between successive openings of the purse."

WIRELESS AT LEAGUE ISLAND.—A new wireless station is being established at the League Island Navy Yard, at Philadelphia. The sending and receiving apparatus formerly used in Pensacola, Fla., has been shipped to the navy yard there. Prof. Stone, who has an experiment station at Harvard University, will take personal charge of the wireless system. The plan, first hit upon by officials at the Washington Navy Yard, of using smokestacks in lieu of regular wireless telegraph masts, which are quite expensive, has been followed at League Island. The tall stacks of the power houses between the old and new dry docks are being utilized for this purpose. When finished the station at League Island will complete the chain along the Atlantic coast, the break between New York and Washington having been at this point. The station nearest to Philadelphia up to this time has been at Cape Henlopen. This will become a sub-station to the one at League Island, and both will be under the charge of Captain Henry Hutchins.

TELEPHONY AND POLITENESS.—In referring to a recent circular of an American telephone exchange requesting that the word "please" be omitted from communications to the operator, our London contemporary, *Electrical Times*, says that the incident, though quite unimportant in itself, may serve for a useful object lesson as to the vast importance that the hustler attaches to the future. "He is a pilot forging ahead towards some wondrous object on the horizon, an object so vastly important that 'Please,' and 'Thank you,' together with the luncheon hour, must be thrown overboard in order to lighten the vessel. Surely the perspective is all wrong, when any object looms as large as this. It is to be hoped that the request of the telephone company will not be complied with. But if it were, it would have one of two effects. Either it would cause perceptibly greater delay in the case of courteous persons who marked the omission of 'please' by an awkward halt—naturally one would attempt to word the petition less bluntly—or it would train all Philadelphians to cast off 'please' and 'thank you' from ordinary conversation. The former alternative wastes more time on the telephone than 'please'; the latter would ensure the Philadelphian very scant attention in his commerce with beings less highly civilized than himself; also a question of dollars."

PLENTY OF ACCIDENTS.—Last week, the secretary of the Public Service Commission, Travis H. Whitney, turned in his first report of accidents reported by the various New York traction companies. The time covered was from Aug. 5, when the board's order became effective, until Aug. 31, 26 days, the number of accidents reported in Greater New York reaching the enormous total of 5500. The list of accidents as given in the report was as follows: Persons injured in car collisions, 145; persons injured in collision with vehicles, 465; persons struck by cars, 405; persons injured boarding cars, 641; persons injured alighting from cars, 1263; employees injured, 641; derailments, 33; injuries on stairways, 26; other accidents, 1881; total, 5500. Of the total number of accidents reported a majority, it will be seen, were of a serious nature. In the 26 days 189 persons were either killed or seriously injured. The further classification on the report shows: Persons killed, 42; fractured skulls, 10; amputated limbs, 10; broken limbs, 44; other serious injuries, 83; total, 189. The traction companies are required to report all accidents within three days, and the commission has every serious occurrence of the character investigated at once. The records of the commission, however, are not open to "ambulance chasers," and may not be used in damage suits. It is said the board will begin an investigation to determine some means of further safeguarding human life.

The New Power Plant of the Lowell Electric Light Corporation.

A NEW turbine power station is now under construction for the Lowell Electric Light Corporation, at Lowell, Mass., under the designs and supervision of the Stone & Webster Engineering Corporation, of Boston. The plant is located at the corner of Perry and Pond Streets, about half a mile from the center of the business district and adjoining the present plant of the Lowell company on the east bank of the Concord River. The building is in a sense an extension of the existing plant, but the plans provide for the remodelling of the old plant and replacement of old machinery as the new plant expands. Fig. 1 shows the lot plan and general arrangement of the two stations. The expansion of the new plant will at first proceed in the direction of the old station, but the company's real estate holdings also provide for extension in the opposite direction if it becomes desirable.

The new building is a brick structure with concrete foundations and steel framework; the floors and roof being of reinforced concrete. Its overall dimensions are, length 75 ft. 9½ ins., width 108 ft. When extended, the station is designed for an ultimate capacity of eight 1500-kw turbo-alternators.

The old station is shown in plan in Fig. 3. It contains a number of belted and direct-connected units, the largest being a 675 kilowatt set. The total capacity of the old plant is upwards of 3300 kilowatts. Thirteen Scannell & Whaley boilers of 150 horse-power each constitute the steam generating equipment. The service includes 2200 volts alternating current, 550-volt direct current and constant-current arc lighting from tub transformers. Some of the direct-connected machines are in excellent condition and will probably be retained in service for some time to come. The comparison of the old station plan with that of the new plant, however, shows that a more symmetrical expansion, greater compactness and a much more convenient operating arrangement, with higher efficiency of production, are possible in the new installation. By retaining the old equipment in service as long as it is desirable to do so and at the same time being in possession of plans for complete modernization, the company is in a position to enjoy the benefits of a progressive design without interfering with the regularity or its present service in any way. No abrupt change from one station to another will be necessary as the development proceeds.

A track of the Boston & Maine Railroad passes the plant on its west side, and as shown in Fig. 1 a spur track leading from this connects with a siding, and also with two parallel tracks running from north to south at the north of the power house. The coal handling and storage system of the station is one of its most interesting features. The tracks are carried on trestles above a yard, which has a storage capacity of 5000 tons, and are traversed by a 10-ton locomotive crane, having a boom of 40 ft. maximum radius and 12 ft. minimum radius. The crane is shown in elevation in Fig. 1. The locomotive

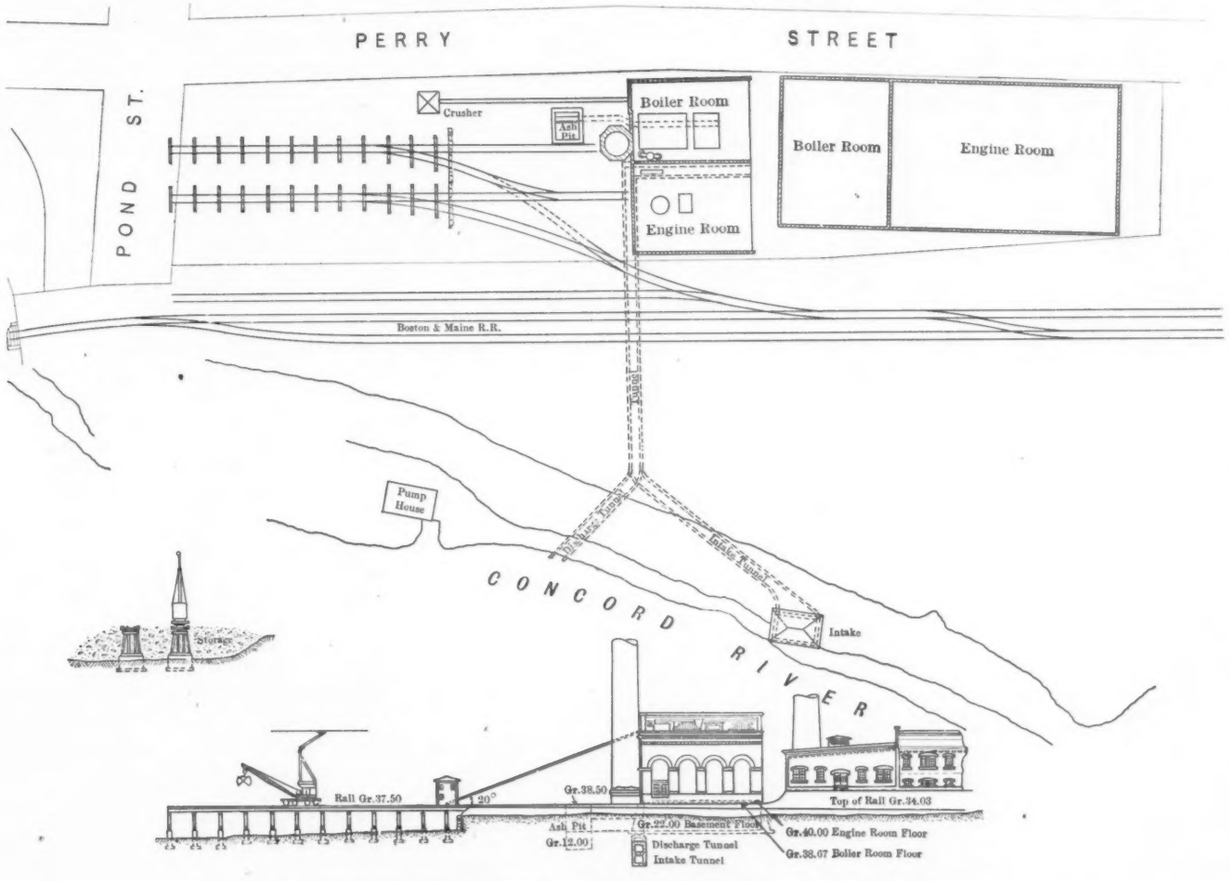


FIG. 1.—LOT PLAN AND GENERAL ARRANGEMENT OF NEW AND OLD POWER HOUSES.

crane was supplied by the Brown Hoisting Machinery Company, and its lifting capacity at 40 ft. radius is 7000 ibs. or 28,000 lbs. at 12 ft. radius. It is provided with a grab bucket of 54 cu. ft. capacity and can be operated simultaneously for hoisting, rotating and truck traveling. At full load the speed of the hoisting grab bucket is 120 ft. per minute, or 164 ft. per minute with empty hook. The track travel speed at full load is 500 ft. per minute, and the crane will climb a 6 per cent grade with full load.

The crane is unusually rugged in design, particularly with respect to the supporting platform and car, the latter being an eight-wheeled unit with a 22 ft. 4 in. wheel base. The crane consists of a boom, drum and motor mounted on a bed and

rotating on the main platform. The latter is formed of a heavy center casting to which is bolted a frame made of heavy steel channels and beams, the truck axle bearing brackets being fastened to the under side of this frame. The center casting carries on its top a support for a steel slip ring by means of which the crane is rotated on its axis. Above this is the rotating bed or housing upon which all the mechanism is assembled. The motor is mounted on the rear of this bed and between the motor and the mechanism is located the operating platform, with all the levers within convenient reach. Two standard four-wheel trucks like those of a 50-ton freight car are used, and the motor is an 80-hp General Electric machine wound for 600 volts, direct-current. A double trolley wire of No. 00 section is used, and to enable the locomotive to be operated on the Pond Street tracks, where no overhead trolley construction was allowed, provision is made for a flexible cable and plug connection with jack boxes on poles at the side of the

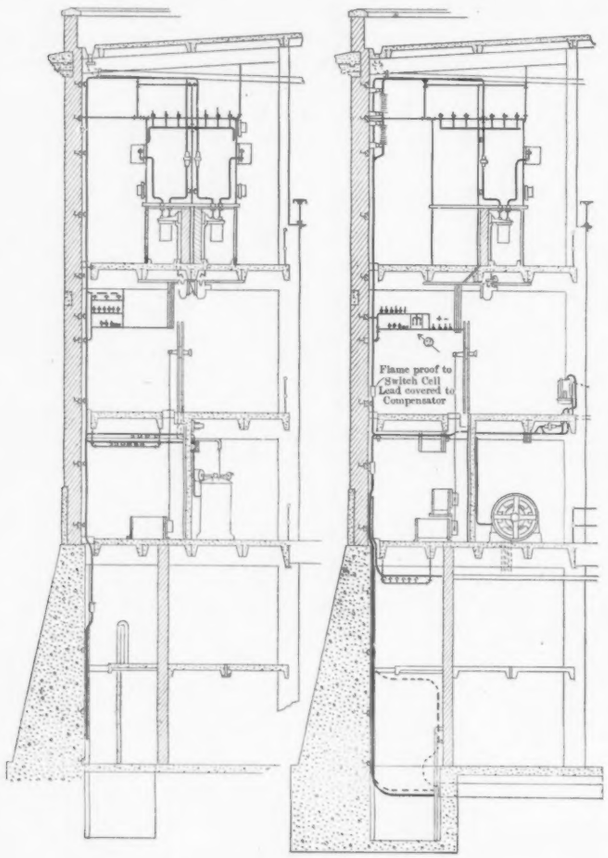


FIG. 2.—ELEVATION OF SWITCHING GALLERIES.

track. The length of the locomotive crane boom made it necessary to support the double trolley wires 45 ft. above the rails, and this called for poles of chestnut varying from 55 ft. to 75 ft. in length. The flexible cable for the locomotive crane consists of 500 ft of No. 1 copper. The crane has been invaluable during the construction of the power plant.

After coal is delivered from the cars into the yard beneath the trestle tracks it is hoisted by the crane and deposited in a crusher located at the west side of the yard. The coal handling system from this point to the bunkers in the power house was supplied by the Exeter Machine Works, of New York. The pocket in the power house has a capacity of 500 tons, and the system, a capacity of 50 tons per hour. The crusher is of the steel-toothed type, and is driven by a 20-hp, 550-volt General Electric direct-current motor. Coal is carried up to the pocket over the boiler room by a 16-in. belt conveyor. Beneath the coal bunkers in the boiler room is a 1000-lb. traveling weighing hopper, hand-operated, with chutes which deliver to the boiler room floor in front of any desired boiler. These chutes are designed so that they can be superseded by chutes connecting with mechanical stokers, in case it becomes advisable to give up hand firing in the future. The power house roof is designed for a load of 40 lbs. per sq. ft. About 280 tons of structural steel were required in the plant.

The boiler room is at present 75 ft. 9½ ins. long, its width being 49 ft. 6 ins. inside. It is separated from the turbine room by a 17-in. brick fire wall. Most of the auxiliary equipment is located in the basement. There are at present three 525-hp Stirling water-tube boilers in the plant, each being equipped with a superheater in the middle pass, for 150 degs. superheat. The boilers are provided with six sets of Gardner rocking grates, and each boiler has 5267 sq. ft. of heating surface, 91 sq. ft. of grate surface, and 1162 sq. ft. of super-heating surface. The draft is controlled by a Mason damper regulator. Eight-in. New Bedford stop valves are used with Walworth pipe fittings. Beneath the boilers is a 16 ft. 8 in. basement. Ashes are collected in hoppers here and dumped into ash cars running on a 36-in. gauge track which leads to an ash pit just beyond the chimney. This pit is 15 ft. square and 10 ft. deep, and has a capacity of four carloads. The cars have a capacity of 50 cu. ft. each and the ash hoppers under the boilers, 250 cu. ft. each. The basement floor is drained by a pitch of ½ in. in 10 ft. to sumps, the latter being freed through a soil pipe system ultimately leading to the river. Steam, water and oil piping was erected by the Middlesex Machine Company.

At present four feed pumps are planned for, the pumps being Platt Iron Works outside packed outfits located in the basement of the turbine room. The operation of the two stations as one, of course, makes it unnecessary to carry the reserve equipment usually installed in a new plant. The flue is carried beneath the boiler room to the stack, the latter being a Kellogg radial brick chimney 195 ft. high, 11 ft. inside diameter, with an extra firebrick lining extending 50 ft. above the foundation. The first 25 ft. of this lining is 9 ins. thick and the balance 4½ ins. In the space between the lining and the stack are set radially eight 2-in. wrought-iron pipes installed for ventilating the usually dead air space. Half of these are located about 12 ins. from the stack foundation, the rest being near the top to provide circulation. A ring of tile is placed above the opening between the top of the lining and the stack to prevent moisture or soot from entering the annular space below. A baffle wall, with a maximum thickness of 12 ins., is built in the chimney for a height of 45 ft. above the bottom to provide against cross impinging of flue gases in case the stack is used as an outlet for the steam from the boilers on the north side of the power house.

At present the engine room contains but a single turbine. This is a 1500-kw, three-phase, 60-cycle, Curtis-General Electric unit, normal speed 900 r. p. m., and full load current, 377 amperes per lead. It is expected that the full load steam consumption of this unit at 180 lbs. pressure and running condensing with not over 2 ins. absolute back pressure will be about 20 lbs. per kw-hour and about 18 lbs. with 125 degs. superheat. Not over 2 per cent variation from no load to full load in the speed is expected, and not over 4 per cent momentary variation. Substantially the full load water rate is expected from the turbine at 50 per cent over load, both with and without the slight superheat figured. The turbine auxiliaries are a Knowles hydraulic accumulator, a 36-in. Alberger barometric condenser, a single-stage horizontal rotative dry vacuum pump, and a 12-in. volute centrifugal pump driven by a 9 in. x 10 in. Harrisburg engine. All the condensing equipment is of the Alberger type. The barometric condenser column is located in the boiler room between the boiler batteries and the engine-room wall, with hot well below. Two step-bearing pumps are supplied for the turbine. The balance of the auxiliary equipment includes two duplex low pressure Platt oil pumps, a Platt horizontal open heater, capacity 50,000 lbs. of water per hour, from 80 degs. F. to 210 degs. F.; a Clayton climax air compressor, capacity 150 cu. ft. per minute; a 30-ton Niles electric crane, an auxiliary feed service and fire

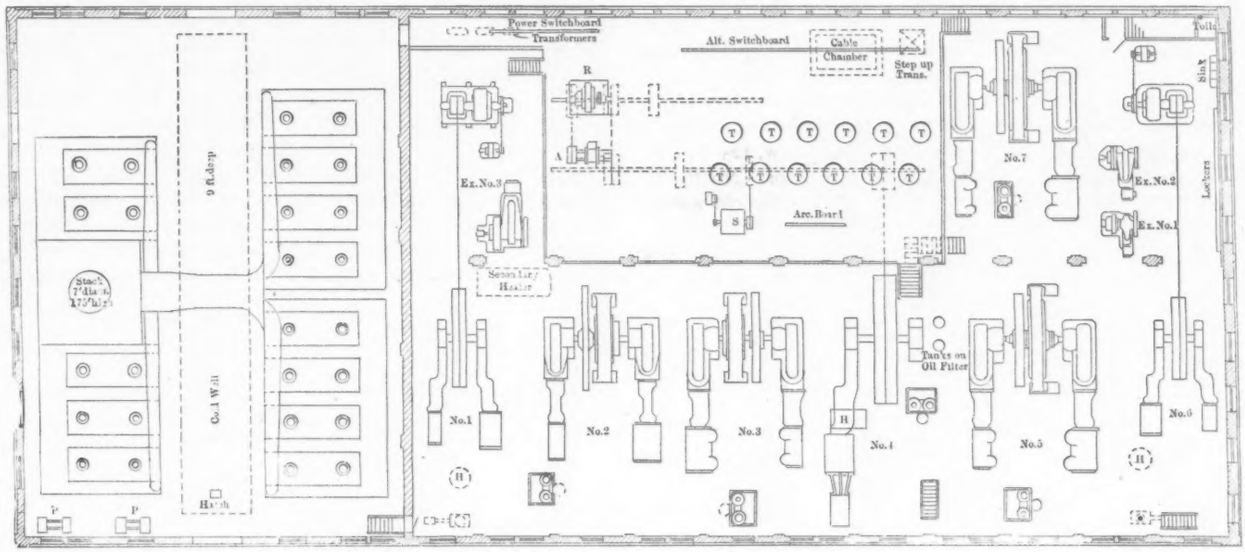


FIG. 3.—PLAN VIEW OF OLD POWER HOUSE.

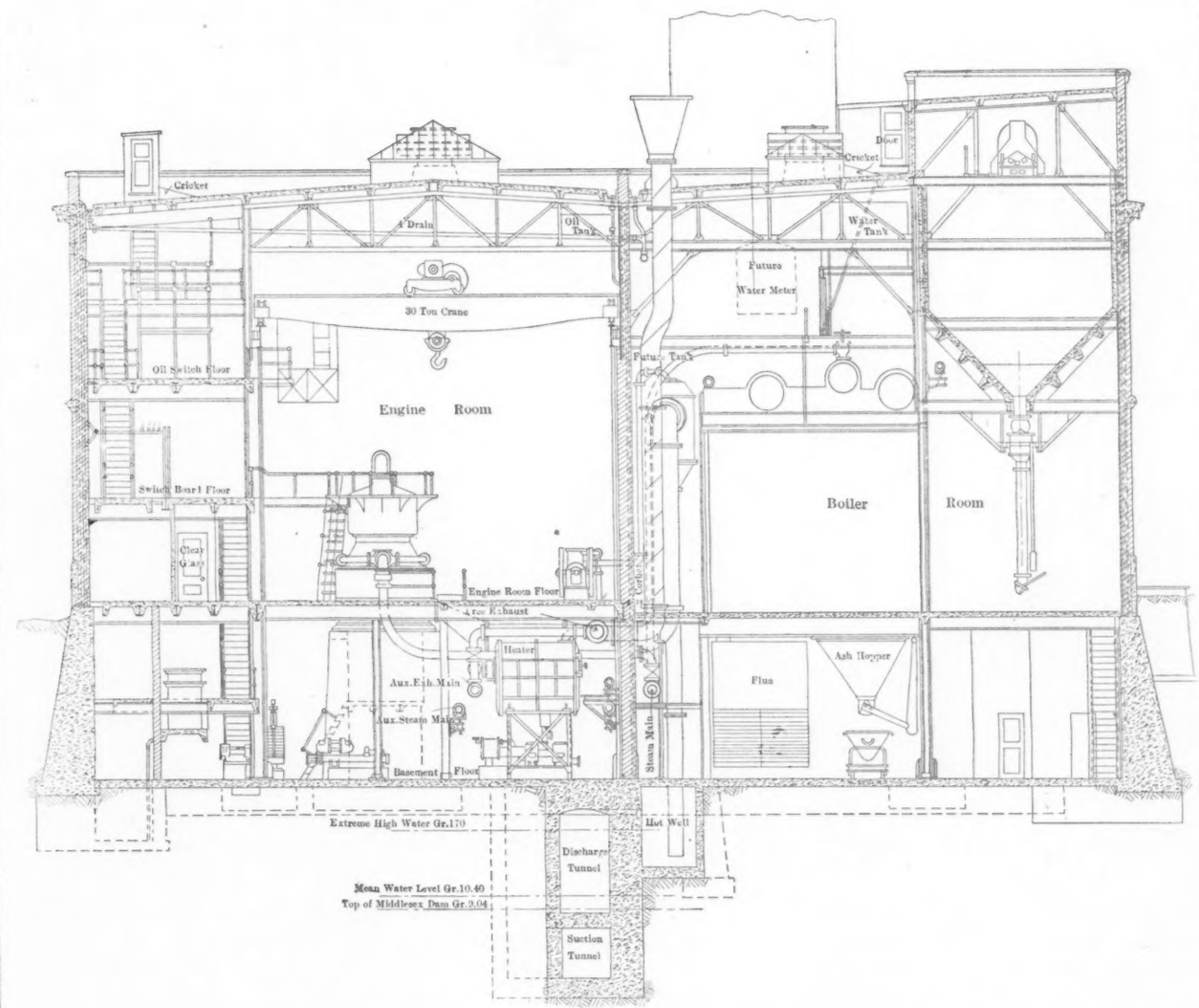


FIG. 4.—CROSS-SECTIONAL ELEVATION OF NEW POWER HOUSE.

NEW POWER PLANT OF THE LOWELL ELECTRIC LIGHT CORPORATION.

pump, and a low-service pump. The air compressor and dry vacuum pump are the only steam-driven auxiliaries located in the turbine room. The rest are in the basement, which is 18 ft. high, and provided with floor plates so that the machinery can be handled with ease by the turbine room crane. The turbine room contains a 500-kw synchronous motor generator set, consisting of a three-phase, 2300-volt motor direct-connected to a 500-volt, direct-current generator, and also a 40-kw, 125-volt exciter direct-driven by a 2300-volt induction motor. No steam-driven exciter is provided in the new plant, as the old station is supplied with this equipment.

The condenser has a capacity of 30,000 lbs. of steam cooling per hour with 70 degs. F. circulating water, the vacuum being equal to 1 lb. absolute pressure. Circulating water is drawn from the river through an intake tunnel 18 ins. thick, shown in Fig. 1, and delivered back to the river through a discharge tunnel located above the latter as indicated. The intake is 5 ft. x 5 ft. in cross-section, and the discharge 5 ft. x 6 ft. The intake is controlled by a gate house located on the edge of the river, from which a wooden intake 150 ft. long and 10 ft. x 2 ft. 6 ins. in section extends towards the middle of the stream. At this writing the intake is being built inside a coffer dam. The excavation in this plant has been unusually troublesome on account of the boulders found in the soil, some of these being 10 ft. in diameter, and even larger. Two charges of dynamite have been required in one or two of the larger cases. A double set of screens has been provided at the intake well for cleaning; a traveling hoist, I-beam 4 ft. long outside the building and a platform are to be built to facilitate washing the screens when they are lifted up from the well. The gate house is unusually complete for a central station design. The well below the gate house is of concrete, reinforced with twisted rods. Chapman steel gate valves are specified.

The design of the new plant provides for an unusual degree of comfort for the employees. Lockers and lavatory for the firemen and coal passers are located in a special room in the boiler room basement, and below the turbine room on a mezzanine floor is a special locker room and lavatory for the engine room staff. At one end of this floor is a barrel runway leading downward from the street, to facilitate the handling of oil. A special oil filter plant, designed by the Engineering Corporation, will be tried out on this mezzanine floor. The piping courses may be seen in a general way in the plans reproduced. The boiler live steam leads are 8 ins. in diameter, and drop down back of the boilers to a 12-in. horizontal steam main in the basement. A 10-in. line connects the main with the turbine through a Cochrane separator. The turbine exhaust is carried through a 36-in. trunk line to the condenser; the usual outboard exhaust being provided also. The piping is arranged for the installation of a water measuring system later, if desirable, in addition to the usual meter. The auxiliary piping is practically standard, a special exhaust line and a separate

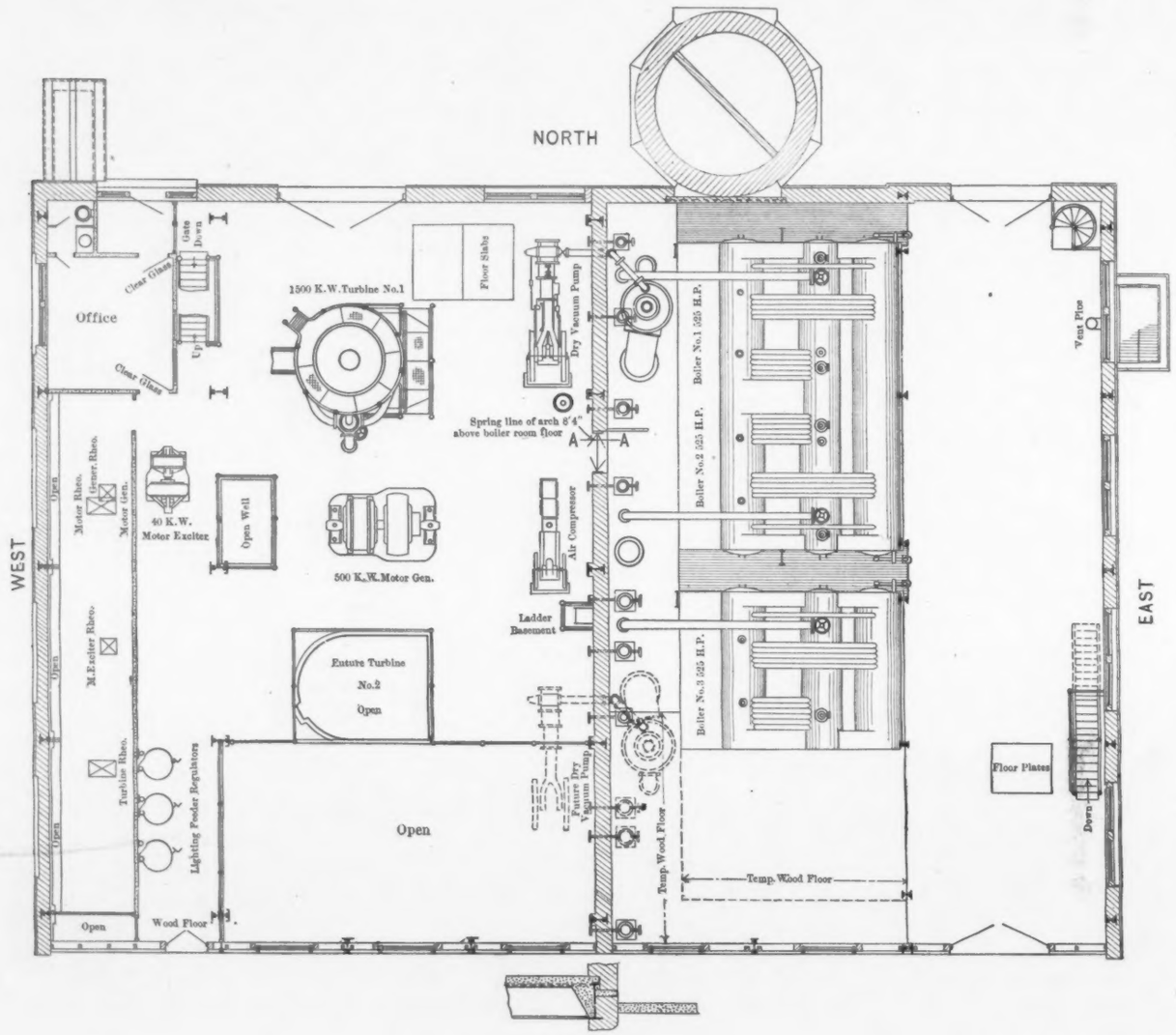


FIG. 4.—PLAN VIEW OF NEW POWER HOUSE.

supply line being maintained for the auxiliaries in groups. The Holly loop system will be installed.

Fig. 2 illustrates in elevation the general wiring scheme of the plant. There are two sets of 2300-volt, three-phase bus-bars carried on a framework in a compartment above the turbine room floor. The generator leads are carried in cable form to an oil switch in this compartment, and knife switches are provided for transferring from one bus to the other when the oil switch is open. The main operating switchboard is located on a gallery, also above the turbine level, and just below the 2300-volt compartments. All the current handled at this board will be low tension. Remote control is provided for the 2300-volt oil switches; the starting compensator, rheostat handles, exciter bus-bars, the line connection with the old station, etc., are all located on the main switchboard gallery. The outgoing circuits from the station, such as lamp and motor feeders, are brought down from the bus-bars and oil-switch compartments to cables which enter underground conduit lines for distribution. The plans provide for the most flexible sharing of the load between the two stations. The switchboard panels are set in their final positions, with gaps between the used sections for the sake of symmetry in the ultimate arrangement. An interesting feature of the new plant is the provision made for lighting the station. Provision is also made for controllying the main steam header from the engine room.

System at Minneapolis for Distributing the Energy Transmitted from Taylor's Falls.

The first issue of the ELECTRICAL WORLD for July contained an article descriptive of the Taylor's Falls power plant, 40 miles from Minneapolis, recently built to supply energy to the Minneapolis General Electric Company. The present rating of this plant is 10,000 kw, but the final rating will be 20,000 kw. In the first issue for September, the 50,000-volt transmission line between this power plant and Minneapolis was described in detail. It is the object of the present article to describe the provisions made in Minneapolis for receiving and distributing the electrical energy.

The general plan is to decrease the e. m. f. from 47,500 to 13,800 volts at the city limits. From a step-down sub-station at the city limits 13,800-volt, three-phase lines connect with the two old generating stations of the company, and also supply energy to a number of small distributing sub-stations, from

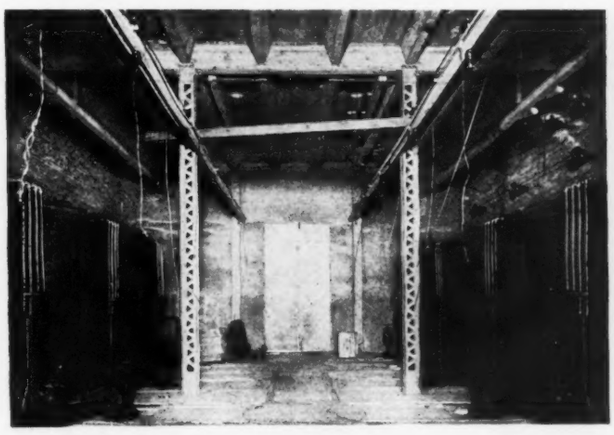


FIG. 1.—STEP-DOWN TRANSFORMERS, TRACKS AND TURN-TABLES.

which it is distributed at 2300 volts, three-phase, to large industries located in the immediate vicinity. It will be noted, therefore, that the distribution system possesses many features which have not heretofore been employed to any extent in large city systems.

SUB-STATION AT THE CITY LIMITS.

At the city limits, at a main receiving sub-station, energy is received from the 40-mile 50,000-volt three-phase line described in the previous article before referred to. The building is thoroughly fireproof, and every precaution has been taken to prevent interruption of service, because all of the energy from Taylor's Falls must pass through it. This sub-station contains nine Westinghousue 900-kw transformers. A view along

FIG. 2.—SWITCHBOARD ROOM OVER TRANSFORMER ROOM.

the middle of the transformer room is given in Fig. 1. Each transformer is mounted on a truck and can be run out onto a turn-table and from there over a track along the middle of the building to the door. The building is provided with concrete floors, the under side of the second floor being shown in Fig. 1. Water for cooling the transformers is obtained from a deep well by means of a pump. There is also a cooling pond adjoining the station into which water is discharged after passing through the transformers. Water can either be circulated from the well or from the pond. The sub-station is provided with pipes for transformer and switch oil, so that oil can be run into any transformer case. There is also an oil-treating tank similar to that in the power station, as described in the article on the power station. The second floor of this sub-station is the switchboard and switch room, shown in Fig. 2. The 47,500-volt wires are kept on one side of the station and the 13-800-volt wires on the other side. Some of the high-tension

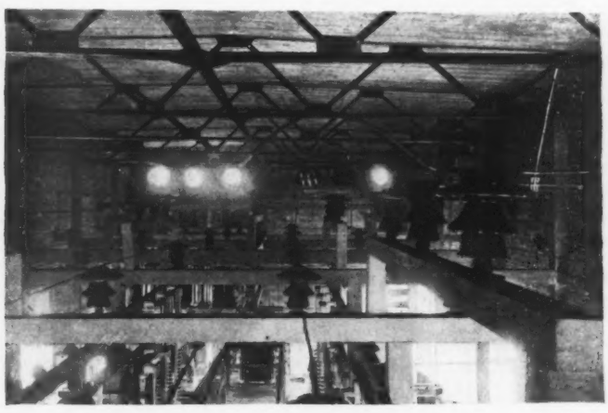


FIG. 3.—15,000 AND 13,000-VOLT WIRES IN TOP OF SUB-STATION.

wiring in the upper part of this floor of the building is shown in Fig. 3, where the 47,500-volt wiring is seen on the right. The general scheme of the wiring of this main sub-station is shown in Fig. 5. The incoming 47,500-volt transmission line after passing the disconnecting switches, choke-coils and series transformers is taken to an oil switch and thence through another set of disconnecting switches to the 47,500-volt bus-

bars. The ultimate plan is to have two sets of 47,500-volt bus-bars which can be connected with an oil junction switch. Every other bank of transformers is connected to one set of bus-bars and the remainder to the other set. The 13,800-volt terminals of the transformers are connected to two sets of bus-bars in a similar manner. The city transmission lines are taken off from these latter bus-bars and are led through oil switches and potential and series transformers to the transmission lines.

THE 13,000-VOLT DISTRIBUTION.

There are three transmission lines leaving the main sub-station, all of which lines feed into the Main Street station of the Minneapolis General Electric Company. This station has heretofore been the principal generating plant. It contains both water power and steam machinery, as will be briefly outlined later. This plant will act as a kind of distributing center. At it the e. m. f. will be decreased to 2300 volts for single-phase distribution for lighting purposes over the entire city outside of the down-town district. The down-town district is served with direct current from the Fifth Street station, which is connected with the Main Street station by two 13,800-volt, three-phase lines, from which energy is obtained for operating motor generators, step-down transformers and rotary converters. The company's offices are in this sub-station; the building in this respect is very similar to the Edison buildings in a number of the large cities of the country. This station is well located to supply energy to the direct-current, three-wire network in the down-town district. The district is limited in area, extending only about a half mile in any one direction from the sub-station. When the area increases, more direct-current sub-stations will be established.

The details of the overhead lines are of considerable interest, because of the use of an e. m. f. of 13,800 volts for general city distribution. On the standard pole-top for the 13,800-volt lines, there are no lower voltage lines. The top cross arm is designed for use with grounded guard wires, as will be explained later. The transmission wires are placed 2 ft. apart. On a pole used for both 13,800 and 2300-volt lines at a sub-station, the 2300-volt lines are placed on the lower cross-arm. An elaborate pole framing at a sub-station is shown in Fig. 7. This particular pole carries a telephone arm which is necessary on some of the lines.

Unusual provisions for lightning protection on the 13,800-volt lines had to be taken because of the severity of the lightning storms and by reason of the fact that there are so many changes from overhead to underground lines. Two grounded

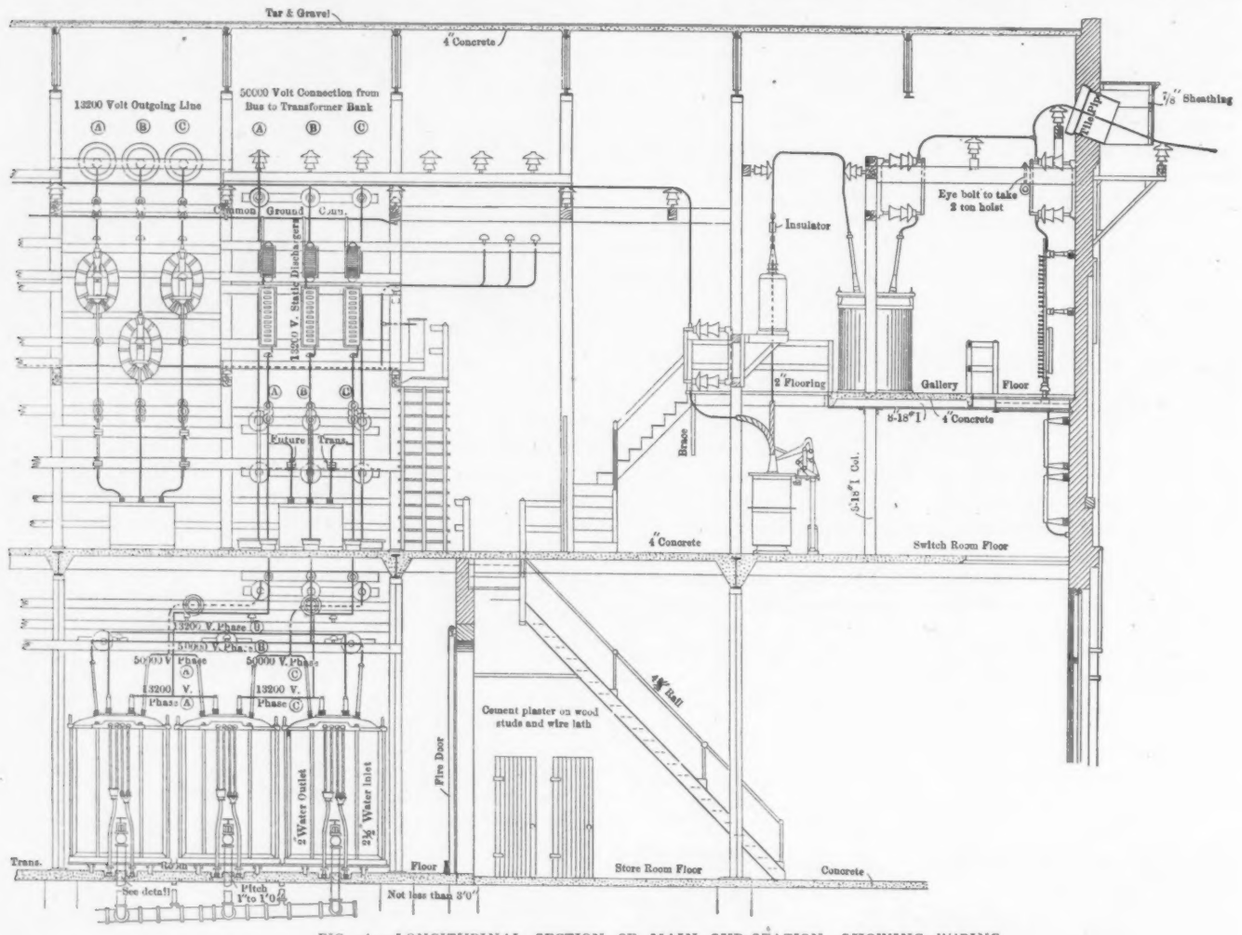


FIG. 4.—LONGITUDINAL SECTION OF MAIN SUB-STATION, SHOWING WIRING.

guard wires are placed on the ends of the top cross-arm. At every third pole the guard wire is grounded to a coil in the bottom of the pole hole for new poles or to a pipe driven in the ground near the old poles. The guard wires are mounted on 2300-volt insulators.

All of the 13-800-volt lines are laid underground except those in very sparsely settled portions of the city. One of the lines leading from the main sub-station, to a secondary sub-station passes underground at two railroad crossings before it reaches the underground district. Lightning arresters are placed at all points of change from overhead to underground. To do this, miniature houses of asbestos lumber were built on the pole tops. Fig. 9 shows the exterior appearance of these houses where the cable terminals are placed on the same poles. Here the cable is led up into a terminal box and the choke-coils are mounted between the poles. For the underground 13,800-volt lines cambric and paper insulated cables are used. Cambric is preferred to paper because it is less liable to become injured when handled roughly, and it is less susceptible to moisture. The cable, which was made by the Standard Underground Cable Company, has 6/32-in. insulation over each conductor and 6/32-in. over all conductors with ⅛-in.

lead sheath. In making a joint on this cable, after the conductors have been spliced each conductor is wrapped with cambric, and cambric tape sleeves or thimbles are used to hold

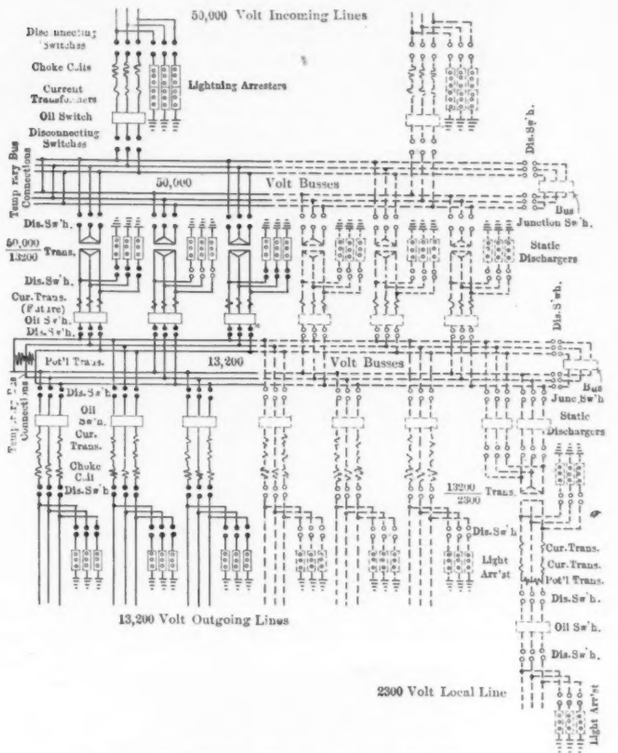


FIG. 5.—WIRING DIAGRAM FOR MAIN SUB-STATION.

the conductors apart when the joint is being finished. The joint, after being covered with lead is impregnated with Minerallac or G. E. 67 compound. The insulators on the 13,800-volt overhead lines are of the Locke No. 3-¾ type, of brown porcelain, and are placed on birch pins.

DISTRIBUTING SUB-STATIONS.

Between main sub-station No. 2, and the Main Street station,

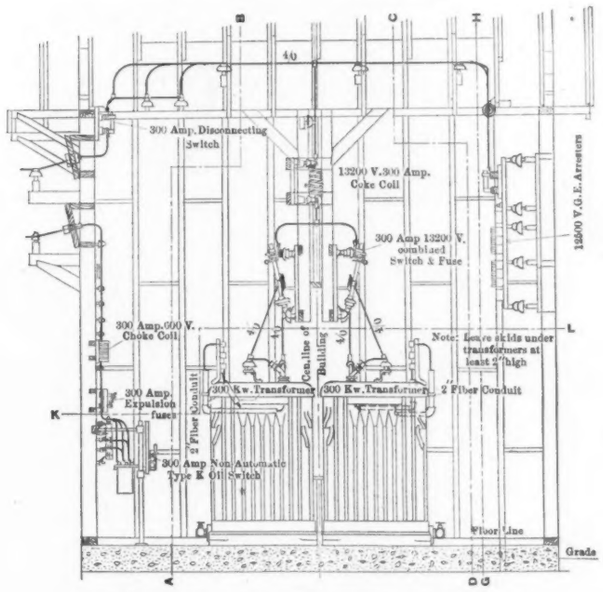

40
300 Amp. Disconnecting Switch
13200 V. 300 Amp. Coke Coil
13200 V. G. E. Arresters
300 Amp 13200 V. combined Switch & Fuse
300 Amp. 600 V. Choke Coil
Note: Leave skids under transformers at least 2" high
300 Amp. Expulsion fuses
2" Fiber Conduit
300 Kw. Transformer
300 Kw. Transformer
2" Fiber Conduit
300 Amp Non Automatic Type K Oil Switch
Floor Line
Grade

FIG. 6.—SECTION OF DISTRIBUTING SUB-STATIONS.

there are located along the three transmission lines various small sub-stations. These sub-stations, which form an interesting feature of the company's distribution, are intended for the purpose of supplying large power consumers only and each contains simply three step-down transformers for reducing the e. m. f. from 13,200 to 2300 volts, three-phase. There are no attendants at these sub-stations. They are located near

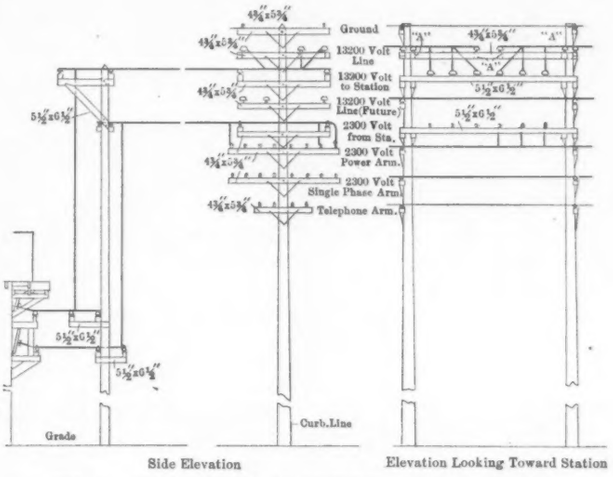


FIG. 7.—POLE DIAGRAM AT DISTRIBUTING SUB-STATIONS.

large power users; it is the intention to limit their output to 2000 kw. Since more power than this will almost never be required at one plant, it is considered better to build another sub-station when the 2000 kw limit is reached rather than to increase the size of the existing stations. Both the 13,800 and the 2300-volt lines are delta connected. The buildings are of galvanized corrugated iron. Since they are usually located in the railroad and manufacturing districts, their appearance is not of great importance. Fig. 6 shows the interior arrangement of one of these distributing sub-stations. Fig. 8 shows the general schemes of wiring a sub-station, the three legs of the circuit being indicated as one wire. The 13,800-volt lines enter at one end of the building and pass down as shown in Fig. 6 through choke-coils and a new type of compound switch and fuse rated at 300 amperes. The lightning arresters shown

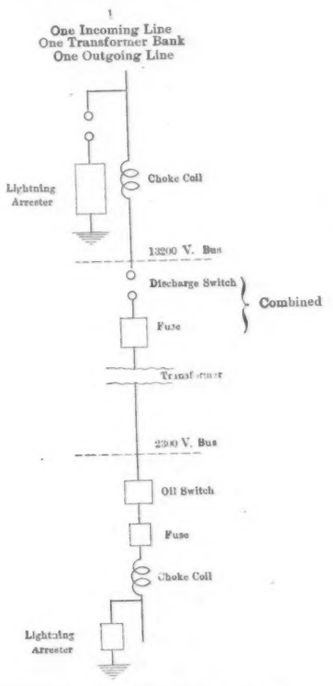


FIG. 8.—DIAGRAM OF CONNECTIONS.

mounted at the right in Fig. 6 are of the new type of shunted gap.

MAIN STREET STATION.

The Main Street station, which is located on the Mississippi

River in the heart of the city, was the principal generating station of the company's system before the circuits from Taylor's Falls were erected. This station is now operated partly by water power taken from the pondage above the St. Anthony Falls dam, partly by steam, and partly by electricity brought in over the tie lines from the main step-down sub-

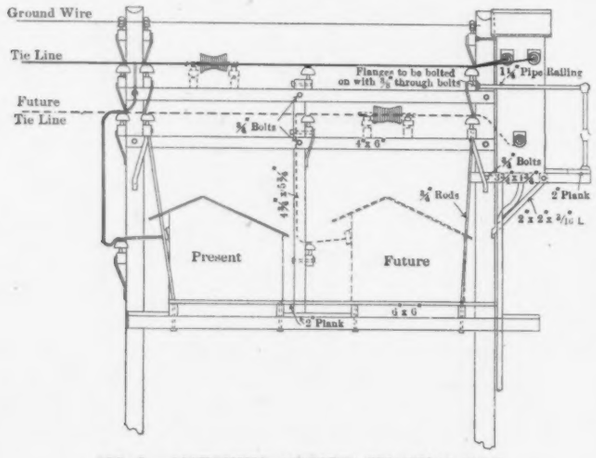


FIG. 9.—LIGHTNING ARRESTER TERMINAL POLE.

station of the Taylor's Falls system, mentioned in a previous article. The station is also arranged to act as an auxiliary to supplement the Taylor's Falls system at times of low water or accident.

The general layout of the station consists of line shafts on one of which is mounted a 1000-kw, 13,200-volt, three-phase machine which can be used to drive the shaft from energy received direct from the Taylor's Falls system or to be driven by the prime-movers in the station, to deliver energy over the 13,800-volt tie lines to the step-down sub-stations of the Taylor's Falls system or to the various sub-stations scattered through the wholesale distributing district. The line shafts are normally driven by the water wheels which are three in number, with a total capacity of 2400 hp assisted by the 1000-kw machine operating as a motor. The relay capacity of the station is still further increased by a recently installed 1500-kw, 2300-volt Curtis steam turbo-generator which is arranged to deliver energy directly to the 2300-volt bus or through the tie line transformers to the tie lines or to the before-mentioned motor on the line shaft. Energy is supplied from this station for 2300-volt, two-phase, 60-cycle distribution, 500-volt, direct-current distribution and for both alternating-current and direct-current arc circuits from machines belted to the line shafts, from motor-generators and from constant-current transformers. In addition to its use as a motor or generator the 1000-kw machine on the line shaft is used as a synchronous condenser to control the power factor of the system. The station is arranged to allow the installation of additional machines of this type, and the general tendency is to simplify and consolidate the apparatus.

FIFTH STREET STATION.

The Fifth Street station is the main sub-station of the Minneapolis system, located at the business center of the city, where it is in the proper position to supply energy to the Edison low-tension system and to control the bulk of the business lighting. The station receives energy from the Main Street station and the Taylor's Falls system; it contains steam auxiliary units and storage batteries. The steam auxiliary equipment consists of 600-kw rating of 230-volt, direct-current, direct-connected, engine-driven generators, 1050-kw of 35-cycle rotary converters, 650-kw rating (on one-hour discharge) of storage batteries; two 100-kw, three-phase, 125 and 250-volt rotary converters, and 1125-kw rating of 13,800-volt air-blast transformers and feeder regulators for the proper control of the potentials of distribution from this station. The high-tension and a large part of the low-tension apparatus of the station is operated from a remote control switchboard.

The Electrical Heating Plant of the Biltmore Estate.

By Charles E. Waddell.

A little over a year ago, under the head of "Current News," the Electrical World announced that an electrical heating plant was being installed in Biltmore House on the Vanderbilt estate, near Asheville, N. C., and commenting thereon expressed the opinion that while the installation might prove an interesting experiment it was scarcely to be hoped that economy would result. The author was convinced that the reverse was true, but preferred giving the plant a year's trial before controverting the opinion. Since just the opposite has proved to be the case, it goes to show that the application of abstract principles to concrete cases may often lead to erroneous deductions, although as an abstract principle the opinion is generally accepted as correct.

In this article the author makes no pretense of offering a technical discussion of the relative merits of electric heating as compared with other sources of heat, but shall confine the text to a consideration of the conditions that lead to the change, a description of the plant, and an account of its performance in daily service.

Separate and apart from the plant that heats Biltmore House there was prior to the installation of the electric heating apparatus a plant which furnished high-pressure steam for operating the laundry and the refrigerating machinery, and in addition thereto a hot-water heater which maintained a constant supply of boiling water throughout the premises. The fuel

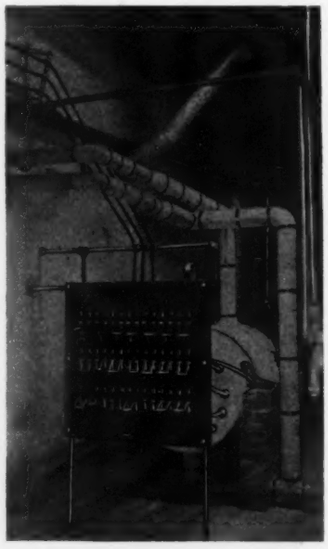


FIG. 1.—100-KW HOT-WATER HEATER.

used was anthracite coal which cost $11 per ton at the boilers. The plants, of course, required the constant services of an attendant. With the item of labor duly apportioned the net cost per annum for this service approximated $2,000.

Electric power is purchased from a hydro-electric plant, and prior to the installation of the electric heating plant electricity was contracted for on a semi-retail basis, the price being 2.5 cents a kw-hour, the load factor and the peak determining the price. By increasing the minimum contract quantity and by maintaining a fairly even load line, energy was to be had for 0.85 cent per kw-hour, an easy condition with which to comply since Biltmore House contains a large storage battery. With these facts in hand it was concluded that the substitution of electric heat might effect an economy.

The refrigerating plant was disposed of by replacing the steam pump and steam compressor with a direct-current motor-driven apparatus. Direct current was selected as the apparatus is more noiseless, and with the proper type of motor, variable speed may be secured.

The contract for the electric heating apparatus was placed with the Hadaway Electric Heating Company, and the success that has attended the installation is largely due to the personal attention Mr. Hadaway accorded it together with his extended knowledge of the subject and its limitations.

Exhaustive tests lead to the conviction that to supply an adequate supply of hot water it was necessary to raise 3000 gallons to the boiling point each day of 24 hours; to accomplish this an

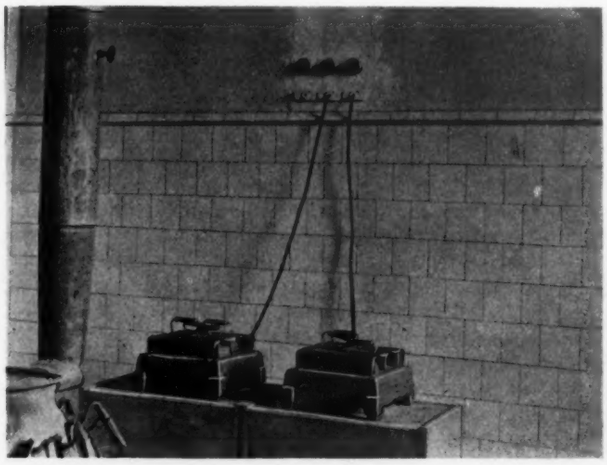


FIG. 2.—ELECTRIC STOVES FOR HEATING LAUNDRY IRONS.

electric heater similar in appearance to a horizontal tubular boiler was installed beside the anthracite heater. The illustration conveys a very clear idea of this piece of apparatus; the heating elements are 20 in number, are arranged in concentric circles, are of a capacity of five kw each, and operate at a potential of 230 volts. The controlling switchboard stands immediately in front of the heater, and contains three banks of switches, each switch being connected with an element, and the three rows connected in star to three transformers on the three-phase circuit. The segregated arrangement is particularly desirable in balancing the load on the main sub-station. It was estimated that it would require 21,600 kw-hours per month to do the work; the records indicate the average for the

FIG. 3.—SECTION OF HEATING ELEMENT FOR DRYING ROOM.

past 11 months has been 12 per cent less than anticipated. The operation is the acme of simplicity. Normally 30 kw are required, two switches on each bank are kept closed, and the elements are worked in rotation from day to day. Unless something out of the ordinary occurs the plant requires no attention whatever. In passing it may be remarked that the power factor of the heating load is unity and the load resembles in many particulars that of the ordinary lighting service.

The laundry presented a far more complex problem than did the hot-water heating. The apparatus in this consists of a mangle, stoves to heat the irons, tub boilers, and dry-room equipment. The mangle was a comparatively simple proposition as it was only necessary to equip the steam cylinder with heating elements and to provide the conventional form of collector rings, taps being brought out for several degrees of heat.

The variety of sizes and shapes of irons led to the adoption of an electric stove rather than the installation of the electric iron. In the electric stove a more rugged form of apparatus could be secured, the item of first cost was materially less, and in case of failure of current supply, resort could be made to the old stove, or in case of an extraordinary rush, both forms of heat could be called into requisition.

By far the most interesting specimens in the whole plant are the tub boilers. An article was demanded that would be economical, quick in operation, safe, and above all "fool-proof" —qualifications that are sweeping and conclusive. Of a number of suggested methods the one adopted consists in introducing

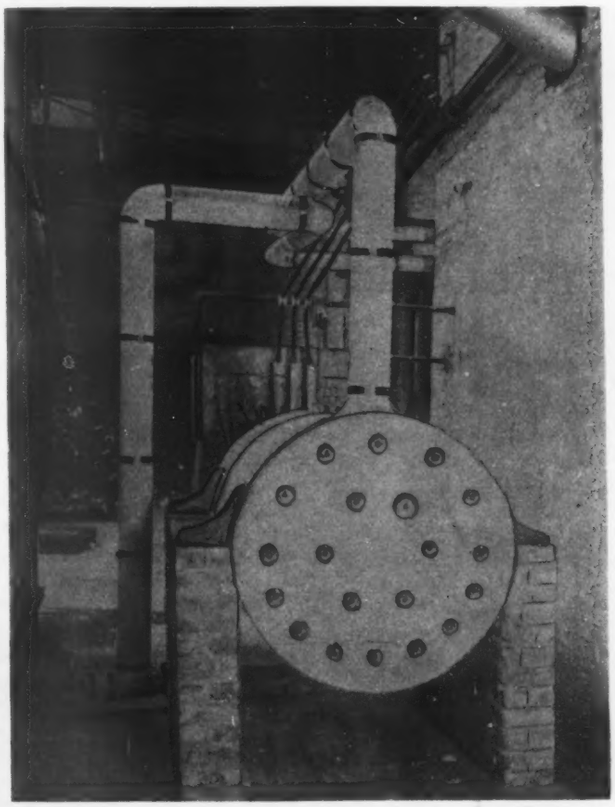


FIG. 4.—REAR VIEW OF ELECTRIC HOT-WATER HEATER.

hot water into a form of vertical boiler in which the temperature is raised above the boiling point, and from which steam passes into the former steam vents in the tubs. The outlet vents are not throttled, and with the admission pipe once adjusted the manipulation consists in merely turning on the hot water and closing the switch. It was at first thought that it would be desirable to provide some interlocking system that would insure the water being turned on previous to closure of the switch; results have not, however, indicated the necessity of the complication, simplicity appearing to outweigh all other considerations.

Formerly the dry room was heated by means of steam coils, and as the room was provided with no means of ventilation, the temperature was above 100 deg. C.—how much above cannot be stated as the thermometer with which the observation was made had not sufficient range to register higher. To maintain any such temperature with electric heat was out of the question, and the solution of the difficulty was the most gratifying incident connected with the installation. To provide a relatively small quantity of heat and relatively large circula-

tion of air was obviously the thing to do and a ventilating fan was at first contemplated. The cost of operating this, however, coupled with the probability of noise, led to its exclusion, for a prime requisite in all apparatus on the premises is absolutely noiseless operation. Nearby the dry room a large chimney rises which extends through the main part of the house and above the roof, and it was concluded to pipe the dry room into a flue in this chimney, providing the flue with a damper, and ascertain the result. The artifice proved the solution; a draft

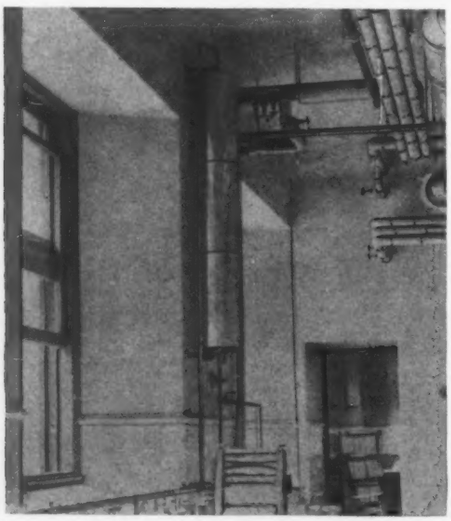


FIG. 5.—TUB HEATER FOR BOILING CLOTHES.

was created that answered all purposes, and gravity by a natural law now does the work at no cost whatever. In service it has been found that a very small opening of the damper sufficed The relatively dry air of the surrounding rooms is sucked into the dry room where it becomes laden with moisture and passes off.

The difficulties attending the installation of this heating plant can easily be fancied when the facts in the case are stated. Tersely expressed, these were as follows: Service had to be maintained without interruption; no dirt or litter was to be tolerated on the job; work was to progress without noise or other evidence that anything out of the usual was happening; conduits of 500,000 circ. mil cables and branches, had to be run through stone walls 6 ft. thick, through marble floors, glass tile wainscoting, and the completed work was to match the surroundings in all respects.

In conclusion, it may be stated that for the year 1905-06 the cost of electric service plus the cost of steam service in this particular branch of the department was approximately $4,100. The cost for the identical service as performed by electricity alone in the year 1906-07 was approximately $500 less.

Municipal Lighting Plant at Clinton, S. C.

Clinton is one of the latest South Carolina towns to install an electric light plant. With over 3000 inhabitants, a large college, and prosperous manufacturing enterprises, it is probable that Clinton would have had electric lamps long ago if its citizens could have been made to realize that the building of such a plant would not mean the destruction of their beautiful shade trees, of which they were so justly proud. Recently, however, the matter was taken up again with the result that quite a little electric light system has been installed that does not in any way interfere with the trees.

The plant, which has just been completed, is owned by the city and is operated in connection with its water works. The power house is a substantial brick building, conveniently located near the center of distribution. The equipment consists of a 100-hp Harrisburg medium-speed engine, one Westinghouse 50-kw, 2200-volt, single-phase, 60-cycle generator, a Westinghouse 25-arc regulator, and such other accessories as usually go with a plant of this size and character. Twenty-four arc lamps, and over 400 108-volt incandescents are now in use, with a demand for practically twice as many of the latter. The plant is, therefore, much too small for the town, and the question of doubling its capacity is already under consideration. At present only night service is given, but during the next month or two it is expected that a day service will be inaugurated.

A unique feature of this little plant is that practically all of its lines are run trolley fashion, in the middle of the streets. This is accomplished by suspending an ordinary four-pin cross arm by a quarter-inch strand from opposite poles. Where arc lamps are needed they are hung beneath the arm, the connection with the circuit being facilitated by the use of a two-point break arm in the place of one of the pins. Transformers are mounted on the poles in the usual manner, their primaries being led up to arms above, thence entirely across the street, and connecting with the street mains at the point where they intersect. Here, ordinary line spreaders are used to give rigidity to the lines and maintain the proper distance between them.

Continuous night service is maintained, and all energy is sold on a meter basis. It has not yet been definitely decided what charge will be made for energy, but until the cost of producing it has been determined, a uniform rate of 12 cents for lamps will be in force. Rates for motors will be decided upon later.

House wiring is done by the town under the supervision of the plant superintendent. The cost of this, including the meter, is borne by the consumer; but the town supplies without charge the transformer and the service wires up to 100 feet, and lamp renewals at schedule prices.

The control of the plant is vested in a council committee at present consisting of A. B. Blakely and C. W. Stone. J. F. Seay is superintendent of the lighting plant, and W. A. Shands is mayor of the town.

Power Investigation on Maine Rivers.

The field work on the government inspection of the power of the principal Maine rivers has just been completed, and the results will shortly be presented in a report to the U. S. Geological Survey. A party headed by Prof. H. S. Boardman, of the University of Maine, and under the supervision of H. K. Barrows, of Boston, district engineer of the U. S. Geological Survey, has just returned from a trip into the valleys of the upper Penobscot River, where measures were taken of various tributary lakes and streams. The purpose in general was to secure data for determining what amount of water, properly collected by a stream or reservoir, is available for power purposes in dry seasons.

The maximum flow of the Penobscot is 60,000 cu. ft. per second; but this is obtained only in the spring freshets, while in very dry times the quantity of water is enormously reduced. Measurements along this river, also around the head waters of the Kennebec, Androscoggin and Saco, are intended to be of great ultimate benefit in preventing waste of water. The water power of the West branch of the Penobscot has been thoroughly measured by previous surveys, so that the work of Professor Boardman's party this year has been entirely in the East branch. Levels were established showing the elevation and area of various lakes and ponds from Chamberlain Lake to Grand Lake dam, the survey including all the principal possibilities in the way of storage reservoirs.

The data will be worked up in the coming winter, and will later be issued in bulletin form for the benefit of those who are considering the establishment of power plants on the East branch. Many large hydro-electric developments have already been started in connection with the principal Maine streams, and additional data of this kind will be valuable to engineers and also to bankers interested in power transmission projects in the state.

The Incandescent Lamp Outlook.

In a paper read before the recent convention of the Colorado Electric Light, Power and Railway Association, Mr. Francis W. Willcox, of the General Electric Company, discussed the present incandescent lamp situation. Referring to the "Gem" or graphitized-filament lamp, he said that by two heatings in the electric furnace (before and after the regular hydro-carbon treatment or "flashing" of filament) the carbon filament is reduced to such a refractory condition that it will give three and one-half times the life (with equal candle-power deterioration) that is given by the ordinary carbon filament, or it will operate at 20 per cent higher efficiency for the same life.

This filament, which has now been on the market for two years, is made in a number of sizes from 250 watts down to 50 watts and substantial progress has been made in its development. The past six to eight months have, he stated, brought forth an improvement of from 30 to 40 per cent in useful life, and materially greater possibilties appear to be in store.

Referring to the tantalum lamp, Mr. Willcox said that over 250,000 have been put into service in this country in the past year, and considerably more would be in use had the manufacturers been able to supply the demand more rapidly. The light of this lamp is distinctly more brilliant than the ordinary carbon lamp. It is made in two sizes, consuming 50 and 80 watts. The 80-watt lamp provides a very economical high candle-power tantalum unit, as a substitute for the ordinary 32-cp carbon lamp with 25 per cent increase of candle-power, or for the 100-watt Gem lamp with the same candle-power.

On direct-current the average life of the tantalum lamp is over 700 hours for the smaller size and 1000 hours for the larger size lamp. The life of an alternating-current appears to be reduced on 25 cycles to about two-thirds and on 60 cycles to about one-half of the direct-current life.

Taking up the subject of the tungsten lamp, Mr. Willcox said that tungsten metal fuses at about 3200 degs. C. and this enables a filament of it to be operated at the remarkable consumption of 1¼ watts per candle with good life—approximately 1000 hours—or, in other words, about three times the efficiency of the present carbon lamp. As tungsten cannot be drawn into a wire, a filament has to be built up, so to speak. One process is as follows: A paste is made of the tungsten powder and some binding material and this paste is then squirted through a die into a thread or filament form. This filament thread is dried, the binding material is removed by suitable processes and the particles of tungsten welded into a continuous wire by the passage of an electric current.

Although the tungsten lamp is fragile, this defect can be minimized by greater care in handling the lamps. Fragility has never proven an insuperable difficulty in any event. What is more fragile than the gas mantle, and yet the difficulty has been overcome and the mantle made commercially satisfactory. It took Edison three days and two nights of steady work to make a carbon filament at first that was strong enough to mount in a bulb. And so it would appear that the fragility of the tungsten is but a temporary difficulty to be overcome.

Mr. Willcox stated that the first tungsten lamp will be a 100-watt type uniform with the present 125-watt Gem lamp. It can be employed on the same reflectors as an incandescent unit and will give just double the candle-power value of the 100-watt Gem lamp.

The added cost of the Gem lamps is so slight that they can be supplied on equal terms with the carbon lamps, and this is the general policy pursued by central stations. With the tantalum and tungsten the case is different, owing to the higher cost of the lamps.

The point in rates where it is economical for the consumer to use these high efficiency lamps can be determined as follows: For the same illumination the Gem saves 20 per cent, the tantalum 33 per cent, and the tungsten 60 per cent in energy over the 3.1-watt carbon filament lamp. If, therefore, the cost of lamp renewals (either the absolute cost or excess cost over carbon lamps according to the policy of the central station) is less than the product of the above percentage saving, times the kw-hour rate, it will be economical to use the lamp; otherwise, it is not. For example, with a 3-cent per kw-hour rate, to economically use the tungsten lamp the renewal cost must be less than 60 per cent of 3 cents, or 1.8 cent; and similarly for the tantalum the renewal cost must be less than 33 per cent of 3 cents, or 1 cent.

There exists perhaps a greater need for a high-efficiency street series incandescent lamp than for any other single type. For this class of service, where low-voltage lamps are chiefly used, the tungsten lamp is specially adapted. For these reasons it has been deemed best to develop this type of tungsten lamp ahead of other types, and the General Electric Company has listed the following types of street series tungsten lamps, the watts per candle being 1.35:

Ampere Range.	Candle Power.	Avg. Total Watts.	Avg. Volts. Per Lamp.
4. (3.7 to 4.3)	32	43	10.8
	40	54	13.5
	60	81	20.25
5.5 (5.1 to 5.9)	32	43	7.85
	40	54	9.8
	60	81	14.7
6.6 (6.1 to 7.1)	82	43	6.54
	40	54	8.18
	60	81	12.27
7.5 (7. to 8)	32	43	5.7
	40	54	7.2
	60	81	18.9

It will be noted that this list covers only ampere ranges from 4 to 7½ and three candle-power sizes. In this an attempt has been made to eliminate a large number of the present types of electric incandescent lamps for series street lighting service which appear to be unnecessary.

Central stations having present circuits running below four amperes can have their transformer coils rewound so as to raise the current to come within the ranges listed. The candle-power sizes below 32 have been eliminated, as it would seem desirable with the improvement in efficiency to adopt higher candle-powers than have heretofore prevailed for street lighting. The previous standard averaged about 25 candle-power, but it is considered that 40 candle-power will be the desirable unit in the tungsten lamp, as this will give an average illumination fully equal to that of the Welsbach street gas lamp.

As street lighting service is sold by the lamp-year, a higher efficiency lamp does not reduce the income (as it might do were energy sold by meter on the watt-hour basis. Central stations should, therefore, receive the full benefit of the saving this new lamp secures. It will even be possible for central stations to introduce the 40-cp tungsten lamp in place of lower candle-power sizes now in use (such as the 25-cp lamp), without any change in rates, and yet secure a material saving, as a simple calculation will show.

A recent test of over 200 30-cp, 5.5-ampere tungsten series lamps on the circuits of one of the large Eastern central stations, gave an average life of 1350 hours.

If we take the 40-cp tungsten as competitor of the ordinary Welsbach street gas lamp, we have the following comparison:

The Welsbach street lamp consuming 3½ cu. ft. of gas for 1000 hours service would cost at $1 per thousand for gas, $3.50. The 40-cp tungsten lamp consumes for 1000 hours 54 kw-hours, which would give an equal cost for the above gas estimate at a rate of about 6.4 cents per kw-hour. For 4000-hour service per year there would be three renewals of tungsten lamps at a total cost of $3.60, and the renewal charge for Welsbach mantles will probably be not much less than this.

Inasmuch as this is a long-hour burning class of service and a load of considerable size, it would appear that stations could profitably compete with Welsbach lamps for this class of service.

Street series lamps, of course, are not sold on the kw-hour basis, but on fixed charge per lamp per year, covering energy and lamp. With the 40-cp, 54-watt tungsten lamp an annual (4000 hours) service would amount, at 6 cents per kw-hour, to $13. Adding to this the cost of tungsten lamp renewals ($3.60) we have a total cost for annual service with lamp renewals of $16.60 per lamp per year. The rate of 6

cents seems to be a good one for this class of service, and stations could perhaps figure profitably at a lower rate.

Incandescent lamps have obvious advantages in street lighting work, as with the low candle-power sizes described they can be distributed at frequent intervals, thus securing a very uniform distribution of light as compared to the massing of greater total candle-power at greater distances apart, necessary with high candle-power illuminants.

Central stations need not fear any reduction in revenue from the introduction of these high-efficiency lamps, as it will hardly be possible to introduce the lamps fast enough to produce any immediate effect. As for permanent effect, the increased business resulting from the introduction of more efficient types of lamps will more than offset any reduction in revenue from the use of such lamps by present customers.

Electric lighting probably does not do more than 20 to 25 per cent of the lighting service of our cities, and there exists in the remaining 75 to 80 per cent of competitive forms of light a large lighting business which the introduction of these high-efficiency lamps will enable central stations to capture.

High Efficiency Lamps and Central Station Revenue.

By H. S. Knowlton.

One of the sustained undercurrents in the minds of central-station men at this time is the probable effect upon their revenue of the coming high-efficiency lamps. Anxiety is not lacking that the general use of the public of individual lighting units approximating a consumption of 1.2 watts per candle-power or lower will result in a shrinkage of income, which will not be offset by any widespread increase in the use of electricity for illumination. This feeling was expressed at the recent convention of the Canadian Electrical Association in Montreal, though the majority of speakers had faith that the industry will not be injured by lamp improvements.

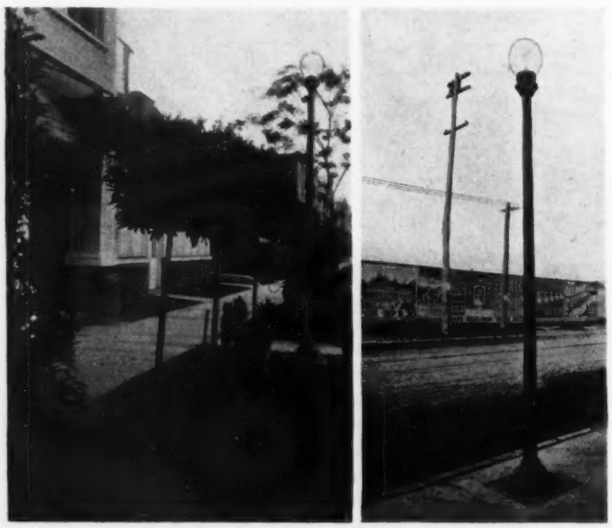
Looking at the matter in a broad way, it is difficult to see any real ground for apprehension. The central station is secure enough at present, for the lamp manufacturers could scarcely manage without many sacrifices to produce the new types on the enormous scale required for a general change from the carbon filament in less than five years. There is plenty of time to think about the problem, and without doubt the Canadian association did wisely in appointing a committee to consider it during the following year in a serious and careful way. Conditions vary so much in different cities and towns that it is well worth while to secure more than one point of view in facing the future of the lamp income.

Supposing that a one-watt-per-candle commercial lamp, capable of meeting the same varied service as the carbon filament and bettering it with respect to life and depreciation, becomes generally adopted, surely an enormous increase in new business is bound to follow the commercial marketing of such a lamp and hundreds of residences in strong "gas cities" are certain to declare for electricity where they knew it not before. Of course, a certain amount of investment must be made for each new house connected, but by bunching the secondary loads on larger transformer units, instead of supplying each house with a separate step-down outfit, a distinct saving can be made. Surely it is the gas man and not the electric-lighting man who will have to sit up o' nights scheming how to meet the new and still-to-be-developed electric illuminants. The larger the connected load in numbers of residences the more probable it is that the maximum peaks will not come at the same time. After all, there is little reason to believe that gas will be driven entirely out any more than has the telegraph by the telephone. The fields of each illuminant will become more clearly defined and, while from an electrical standpoint it is not easy to see that rival illuminants are mutually beneficial, the probabilities are strongly in that direction.

The central-station man who figures his income and expenses on the lighting basis alone overlooks the main tendency of the times in the supply of commercial electric service. The lighting and power developments of a modern company cannot be separated in the total yearly balance sheet. Each department should be self-supporting and as profitable as possible, but co-operation in handling loads at different hours, in economizing by avoiding duplications of duty on the part of employees, and by sharing expenses of outfit and administration, is essential to the best results. Anything which increases the use of electricity in one field tends to increase its use in others. That is a certain result of electrical development in the last decade or two and it bids fair to hold in the field of highly efficient lamps. Heating, motor and sign applications are constantly at hand to help absorb the station output, and at the rate with which new business is being pushed by the lighting companies in both the commercial and the residence fields, one may be reasonably certain that any improvement tending to popularize the sale of central-station energy will, in the long run, be an unmixed good.

Neat Posts for Incandescent Lighting.

A flat and store building on Forty-Seventh Street, Chicago, has adopted a system of special lighting on the street in front of the building which consists of neat iron posts of the type shown in Figs. 1 and 2. These posts carry sand-blasted globes.



FIGS. 1 AND 2.—POSTS FOR INCANDESCENT LAMPS.

In each globe is a 100-cp Gem lamp. This makes a very simple plan for special lighting of business streets in smaller towns and in the outlying districts of larger cities. In order to get good effect, however, it is necessary to place these posts at rather more frequent intervals. To get distinctive effect, they should not be over 20 ft. to 30 ft. apart.

Special Offer for the Wiring of Small Houses at Dayton, Ohio.

The Dayton (Ohio) Lighting Company is making a special effort to secure an entering wedge for the wiring of a list of old residences. To this selected list of residences the following offer has been made:

For $36 the company will equip the house so that electricity may be used in the following rooms: Main hall, one lamp and switch; living room, three-lamp fixture; dining room, two-lamp fixture; kitchen, one lamp; kitchen one receptacle for electric iron.

This price is based on the use of straight electric fixtures in the hall, living room and dining room and kitchen. Should combination gas and electric fixtures be desired, the price will be $42.50. The company has a standard set of fixtures which it installs under this offer, and which are kept on

exhibition at the offices. If it is desired to use other designs, the customer can do so by paying the difference in price. The price was arrived at by taking the average cost of wiring 12 types of houses in Dayton. The wiring work is let out to local contractors, and while the cost in different houses varies, the average has come out all right. If more lamps are desired, it is provided that the customer may secure them at approximately proportionate cost.

Electric Cooking Record from a Small Family.

Mr. E. L. Callahan, who is the electric heating specialist of the Chicago office of the General Electric Company, gives us the following record for electric cooking at his home in Oak Park for the year ending June 23, 1906. Mr. Callahan's cooking outfit was described and illustrated in the ELECTRICAL WORLD in the first issue of April, 1907. The table gives the costs and energy consumption for doing absolutely all the cooking and baking by electricity covering a period of 12 months.

1906-07	Kw-hrs.		No. days 3 meals ea. 2 people.	No. days 2 meals ea. 1 person.	Equiv. persons per day.
June 23-July 24.....	71	$3.55	31	17	2.55
July 24-Aug. 22.....	71	3.55	29	18	2,62
Aug. 22-Sept. 24.....	31	1.55	17	5	2.30
(House closed 2 weeks).					
Sept. 24-Oct. 22.....	26	1.30	19	4	2.21
(House closed 2 weeks).					
Oct. 22-Nov. 22.....	63	3.15	32	28	2.90
					2.51
Nov. 22-Dec. 22.....	87	4.35	29	16	3.55
Dec. 22-Jan. 22.....	87	4.35	31	25	3.81
Jan. 22-Feb. 22.....	97	4.85	31	22	3.71
Feb. 22-Mar. 26.....	88	4.40	32	12	3.37
Mar. 26-Apr. 23.....	55	2.75	31	2	3.06
Apr. 23-May 24.....	69	3.45	31	8	3.26
May 24-June 23.....	58	2.90	30	9	3.30
One year	803	$40.15	901	166	3.44

Total single person days, 1067.
Total single person meals, 3035.
Watt-hours per person, per meal, 264, at 5 cents per kw-hr., or at the rate of 1.32 cents per person per meal.

The utensils used consisted of a 6-qt. vegetable or soup boiler, a 2-qt. vegetable and cereal cooker, a 2-qt. water heater, ,a 1-qt. water heater, 5-in. frying pan, 7-in. frying pan, 6-in. stove, 12-in. griddle, 12-in. broiler and one oven.

Flaming-Arc Lamps for Billboard Lighting.

It has been generally held that the only satisfactory method of lighting billboards is by incandescent electric lamps spaced around the edge of the billboard, or merely across the top of the board, and covered by reflectors. When, however, billboards assume large proportions it becomes difficult to illuminate them properly by means of incandescent electric lamps unless so large a quantity of these be used that the cost of energy consumed becomes quite an item.

In New York City very many, if not most, of the very large signs on house tops or across the front of buildings are illuminated by means of arc lamps hung some distance away from the sign and provided with a reflector so that the source of light is not at all visible from the sidewalk below at night and scarcely visible during the day. A marked economy in energy consumption is thus obtained without any sacrifice in the proper illumination of the sign. As is well known, the sign business is very profitable in New York City because of the large number and size of the signs and the long hours of illumination with electricity at regular rates.

The United Electric Light & Power Company, of New York City, supplies the electricity for a very large group of signs at the corner of Broadway and Thirty-Fourth Street. The sign is maintained and the contract for lighting it made by a local advertising company, to whom the energy is supplied at schedule rates. With the inherent economy of flaming arc lamps and their great value for advertising purposes, these were naturally employed by the advertising company, to whom the space represents so much money. The sign which is shown herewith by day and by night is provided with 14 55-volt Excello flaming-arc lamps, burning two in series and consuming about 12 amperes. The arc lamps burn from sunset to midnight, and the signs are visible for some distance, the location just bordering on Herald Square. The method of suspending the lamps is clearly shown in the engravings, a glance at which also reveals the fact that the signs are also well lighted, as would naturally be expected from so powerful a source of light.

Electric Traction in Belmont Tunnel.

An official trial trip was made through the north tube of the New York & Long Island Railroad Tunnel, better known as the Belmont Tunnel, on Tuesday, Sept. 24. Representatives from the Interborough Rapid Transit Company, the Degnon Contracting Company, the New York & Long Island Railroad Company and officials from the different city boroughs were present.

The trip from Forty-Second Street and Third Avenue (the present Manhattan terminal station) to Van Aulst Avenue, Long Island City, was made in four minutes. The officials were well pleased with this new feeder added to New York's already great electric railway systems.

All-steel cars are used in the tunnel service. The overhead contact third rail is used. The rail inverted is suspended from moulded mica insulators supported by iron brackets, the brackets being held in place by expansion bolts put into the concrete of the tunnel lining. The tunnel cars are equipped with two trol-

BROADWAY AT THIRTY-FOURTH STREET BY DAY AND BY NIGHT, SHOWING SIGNS ILLUMINATED BY FLAMING ARC LAMPS.

ley poles, one at either end, and with an overhead shoe, thus allowing cars to operate by overhead trolley wire when running on the surface lines of Long Island and by overhead third rail when in the tunnel. Cars coming into the tunnel from the surface will have their poles pulled down and hooked fast, letting the shoe make the contact to the rail while passing through the tunnel. Cars can be coupled in trains and operated by a master controller. The car vestibules are fitted with center sliding doors that can be closed for single car service or left open for train service.

There are two tunnel tubes, each having a single track. The cars fit well into the tubes, allowing only necessary clearance for safety. Good ventilation is looked for in this form of tunnel construction, as the car in motion acts like a huge piston crowding the air forward and out to the ventilating shafts and tunnel stations.

Residence Wiring on Installment Payments in Chicago.

The Commonwealth Electric and the Chicago Edison companies have recently begun a special effort to get houses already built, but not wired, to connect to the companies' lines. To this end a proposition has been formulated whereby the company will wire a house for an owner and spread the payment over 24 consecutive months without interest. The payment of the first instalment is made at the time of taking the contract. The first advertisement of this plan, which appeared in the Chicago daily papers Aug. 29, brought in a host of inquiries, so that the man who had been assigned to devote his time exclusively to handling the customers obtained was overwhelmed with work and several more men had to be added at once. The plan is for each solicitor to follow up the customers in his district that would be likely to accept such an offer. The solicitor works in cooperation with the special engineers and estimators appointed for this work. The solicitor quotes prices for the wiring of different classes of buildings according to the schedule given in this article. The price covers only the wiring to the outlets. Switches and fixtures are extra; switches being charged for according to the switch schedule given. The customer is allowed to select his own fixtures with the understanding that the entire cost, including wiring, switches and fixtures, shall be added together and divided into 24 payments. This proposition is offered only to completed residences and not to residences in process of construction or to business establishments. Only residences already connected to the companies' lines will be taken under this offer. The company has selected samples of suitable fixtures for each room in the ordinary residence and placed photographs of them on display, so that the company will not run the risk of having a customer price expensive and exceedingly elaborate fixtures and become discouraged.

Lamps.	Class "A" Building; two floors with double floors.	Class "B" Building; three floors with double floors.
10	$50.00	$70.00
11	52.00	72.00
12	54.00	74.00
13	59.00	81.00
14	61.00	83.00
15	63.00	85.00
16	65.00	87.00
17	67.00	89.00
18	69.00	91.00
19	71.00	93.00
20	73.00	95.00
21	75.00	97.00
22	77.00	99.00
23	79.00	101.00
24	81.00	103.00
25	86.00	110.00
26	88.00	112.00
27	90.00	114.00
28	92.00	116.00
29	94.00	118.00
30	96.00	120.00
31	98.00	122.00
32	100.00	124.00
33	102.00	126.00
34	104.00	128.00
35	106.00	130.00
36	108.00	136.00
37	113.00	143.00
38	116.00	146.50
39	119.00	150.00
40	122.00	153.50
41	125.50	156.50
42	128.00	159.50
43	130.50	162.50
44	133.00	165.50
45	135.50	168.50
46	138.00	173.50
47	140.50	176.50
48	143.00	179.50
49	148.00	186.50
50	151.00	190.00
51	154.00	193.50
52	157.00	197.00
53	160.00	200.00
54	163.00	203.00
55	166.00	206.00
56	169.00	209.00
57	172.00	212.00
58	175.00	215.00
59	178.00	218.00
60	181.00	221.00

The following is a price list for lamp outlets for flats renting at from $25 to $40 per month, and for houses renting at from $20 to $50 per month, of semi-fire-proof construction. Each switch outlet is considered as one for one lamp. Prices of switches and receptacles are added to the list at store-room prices, as given herewith.

PRICE LIST OF SWITCHES AND SOCKETS.

Flush push-button switch, 10-amp. s. p.	$ .97½
10-amp. d. p. switch flush	1.30
Snap switch s. p.	.24
Snap switch d. p.	.50
Door switch	1.25
Receptacle socket	.35
Floor receptacle, waterproof	2.92
Three-way flush switch	1.09
Three-way snap switch	.50

The following is a price list for lamp outlets for high-class apartments and medium sized residences renting for more than $50 per month, with hard-wood finish throughout.

Lamps.	Class "C" Building; two floors with double floors.	Class "D" Building; three floors with double floors.
10	$75.00	$88.00
11	78.00	91.00
12	81.00	94.00
13	89.00	99.00
14	92.00	102.00
15	95.00	105.00
16	98.00	108.00
17	101.00	111.00
18	104.00	114.00
19	107.00	117.00
20	110.00	120.00
21	113.00	123.50
22	116.00	127.00
23	119.00	130.50
24	121.00	134.00
25	126.00	141.00
26	129.50	145.00
27	133.00	149.00
28	136.50	153.00
29	140.00	157.00
30	143.00	161.00
31	146.00	164.50
32	149.00	168.00
33	152.00	171.50
34	155.00	175.00
35	158.00	178.50
36	161.00	182.00
37	166.00	189.00
38	169.50	193.50
39	173.00	198.00
40	176.50	202.50
41	180.00	207.00
42	183.00	211.00
43	186.00	215.00
44	189.00	219.00
45	192.00	223.00
46	195.00	227.00
47	198.00	231.00
48	201.00	235.00
49	206.00	242.00
50	210.00	246.50
51	214.00	251.00
52	218.00	255.50
53	222.00	260.00
54	226.00	264.50
55	229.50	268.50
56	233.00	272.50
57	236.50	276.50
58	240.00	280.50
59	243.50	284.50
60	247.00	288.50

It should be remembered by central-station men that conditions as regards the cost of wiring in Chicago are radically different from those in the smaller cities and towns. The class of residences for which this schedule is drawn up has brick outside walls and hardwood floors, which in itself makes wiring more expensive than in frame houses. Then, too, the cost of labor is very high in Chicago, and the rigid city wiring rules makes the construction more expensive than is common in smaller towns.

Establishing the Right to a Patent on the Ground of Priority.

By John E. Brady.

It is a fundamental rule of the patent law that patents are issuable only to first and original inventors. The rule as stated is not involved, but an explanation of the meaning of the term "first and original inventor" is essential to a clear understanding of the situation. Where two or more persons, independently of each other, have worked out the same invention, each is an original inventor, and, but for the other or others, would be entitled to the patent. Two patents, however, cannot be granted for the same invention, because an exclusive privilege cannot subsist in distinct individuals and also because the issue of one patent exhausts the power of the government to afford protection to the inventor. Hence, the law is compelled to choose between rival inventors and confer the exclusive privilege upon the one who in reason seems best to deserve it. This it does by providing that the first or earliest in time of these rival inventors shall be regarded as the only true inventor. Robinson on Patents, Sec. 370.

No serious difficulties are presented in regard to the question of priority under the English law, because there the date of the application for a patent is considered the date of the invention, and the first patentee or applicant for a patent is held to be the first inventor. But in this country the courts will go behind a patent already granted or an application for a patent, to ascertain whether the patentee or some rival claimant was in fact the first inventor, and priority is awarded to him who first performed the inventive act.

Where one of two rival inventors has reduced the idea to practice before the other has conceived the idea, the former is unquestionably the first and true inventor. Where their conceptions are simultaneous and one of them precedes the other in putting his idea into practice, his earlier completion of the inventive act renders him the proper patentee. But where the one who first conceives the idea is anticipated in its reduction to practice by another and subsequent originator of the same idea, an additional test of priority must be applied. The rule here is that the first conceiver must show that he has exercised proper and due diligence in rendering his invention available for public use. And if he does this, he will entitle himself to the patent, although a subsequent conceiver was first in putting his idea into practice and in filing his application for a patent.

Suppose that an inventor has been working upon a patentable idea, and has advanced his work to a point where he is about to apply for letters, when he hears for the first time that a patent has already been granted upon substantially the same device, or that an application for such a patent has been filed. Or suppose, on the other hand, that after one has filed an application or secured a patent upon a machine or process which, so far as he is concerned, originated in his mind, he is informed that a rival inventor claims to have been ahead of him in point of time in making the invention, and although he has taken no active steps to secure a patent, announces his intention of claiming such a right. The question of inventorship then becomes an issue, the determination of which depends upon which party is entitled to be considered the first and original inventor. The original inventor is justly entitled to the patent regardless of the time of the filing of his rival's application; but if the other inventor is first in getting in his application, it rests upon the inventor claiming priority to establish his position, and his right to be considered the original inventor. To do this he must show that he was the first to conceive of the invention, and if it appears that the rival inventor was the first to put his invention into practice, then he who claims to be the original inventor must show that he used diligence in carrying his idea to completion. In such a case, if he has been lacking in diligence, then his prior conception will not help him and the patent will go to the rival.

As invention takes place at the date of conception, it is necessary to know what is meant by the term "conception" and when conception, within the meaning of the patent law, takes place. The point of time is neither when the first thought of it was conceived, nor when the practical working machine is completed; but it is when the thought of conception is practically complete; when it has assumed such shape in the mind that it can be described and illustrated; when the inventor is ready to instruct the mechanic in relation to putting the idea into working form; when the embryo has taken some definite form in the mind and seeks deliverance, and when this is evidenced by such description or illustration as to demonstrate its completeness. The true date of the invention is the date when the work of the inventor ceases and the work of the mechanic begins. Up to that point he was inventing, but had not invented, and he must have invented before the law will come to his protection. Cameron & Everett vs. I. R. Brick, 6 C. D., 171.

It follows, then, that the date of the conception is the date when the idea of means, including all the essential attributes of the invention, becomes so clearly defined in the mind of the inventor as to be capable of exterior expression, and it is settled both by practice and express decision that such exterior expression of the mind of the inventor, when relating to machinery, may be by exhibits either in the form of models or drawings, if thereby the invention be made sufficiently plain to enable those skilled in the art to understand it. Webster Loom Company vs. Higgins, 105 U. S., 580.

As has already been said, invention dates from the time of conception. If diligence is used in reducing the invention to practice, an inventor may be granted a patent, although another has filed his application first, or even has been granted a patent; so when an inventor finds that he is in a position where, in order to gain a patent he must prove a prior conception, a question arises as to the nature of the proof to be required of him. Where a patent has already been granted to another, the patent is presumptive evidence that the patentee was the original inventor, and in order to overthrow this presumption, evidence must be given which is free from doubt. Stonenietz Printers' Machinery Company vs. Brown Folding Machine Company, 57 Fed., 601.

The mere uncorroborated word of an individual that the idea for a device, already protected by a patent granted to another, occurred to him before the patentee thought of it, will not suffice to set aside the patent. If he can produce a sufficient number of witnesses in support of his word he may gain his point, but, as it is only natural that the inventor working upon an unperfected device, will refrain from general and open discussion of the idea until he knows that he may do so without fear of someone else jumping in ahead of him and applying for the patent, and that until such time he will keep the matter as close a secret as possible, it follows that, in many cases, he will not be able to produce the necessary corroborative testimony along these lines. The inventor, however, may, as a general rule, make drawings and sketches without rendering his idea public property, and these drawings are liable to be of assistance to him if it later becomes necessary to satisfy a court of law as to his right to a patent.

The fact of conception by an inventor for the purpose of establishing priority cannot be proved by his mere say-so, nor by his unsupported testimony where there has been no disclosure to others, or embodiment of the invention in some clearly perceptible form such as drawings or models with sufficient proof of identity in point of time; for otherwise such facile means of establishing priority of invention would, in many cases, offer great temptation to perjury, and would have the effect of virtually precluding the adverse party from the possibility of rebutting the evidence. Hence, it has been decided in many cases that the mere unsupported evidence of the alleged inventor, on an issue of priority, as to the fact of conception and the time thereof cannot be received as sufficient proof of the fact of prior conception.

It will be remembered that in the first electric railways, in which the wire conductor conveying the electricity was suspended

above the car, the car maintained contact therewith by means of "overrunning" trolleys connected with the car by a cord or similar means and towed along above the surface of the conductor. These devices were found impracticable for general use because of uncertainty of connection, lack of adaptability to various forms of switches, liability to derailment, and for other reasons. The problem presented was how to make practicable the propulsion of electric railway cars by a continuous contact under all the conditions presented by crowded streets, sharp curves, complicated switches, rough roads, and the necessity of a continuous upward pressure of from 8 lbs. to 15 lbs. The solution was worked out by Chas. J. Van de Poele, who devised the scheme of maintaining contact by the familiar overhead trolley described as "the long, swinging, pivoted, hinged, and upwardly spring-pressed arm extending from a support on the top of the car and equipped with an underrunning contact device." Two patents were issued to the administrator of the inventor after his death and the validity of these patents was made an issue in an action by the Thomson-Houston Electric Company. The action was instituted for the purpose of restraining an infringement of the Van de Poele patents, they having been assigned to the Thomson-Houston Company, and it was offered in defense that Van de Poele was not the original inventor, but a former employee of Van de Poele, named Verstraete. Verstraete testified that the trolley as constructed by Van de Poele was impracticable, and that, as Van de Poele desired to perfect the device in time to exhibit it at the Toronto Exhibition, and had very little time, Verstraete, himself, went down to a shop in that city and constructed a crude form of the patented trolley. Van de Poele, in his application for a patent, had sworn that he was the original and true inventor, and it did not appear that, during his life, any other person claimed the credit of the invention. It was held that such evidence of a former employer given, after years of silence, would not be taken against the oath of the patentee, especially when other evidence in support of the patent was not accessible. Thomson-Houston Electric Company vs. Winchester Ave. Ry. Co., 71 Fed. Rep., 192.

Of course, there is no set rule by which to determine all cases where the question of priority of conception is involved, and the determination of each particular case depends upon the facts presented. But, that clear and convincing proof of prior conception must be furnished before a court will award patent rights, is shown in Rudolph vs. Williams, 62 Fed. Rep. 577. The question was one of fact whether Rudolph or Williams was the inventor of an improved method of "feeding the reciprocating blade of a stone sawing machine." Rudolph sued Williams to obtain an adjudication that he (Rudolph) was entitled to the patent. Prior to the making of the invention involved, saws had been constructed so as to cut only during the forward movement of the saw; that is to say, the feeding mechanism of the saw operated only during the forward movement of the blade and was not in operation during the backward movement. The invention, to which each party laid claim, enabled the saw to cut both ways and so accomplished more work with a given amount of power than could have been done before. Williams' statement was to the effect that he conceived the invention in July, 1886, and that he explained it to Rudolph, who was then in his employ as an engineer. He afterwards instructed Rudolph to attach the invention to a saw which he, Williams, owned, giving full directions as to the construction of the device and the method of applying it. He also stated that in October, 1886, he made a pencil drawing and submitted it to his solicitor from which to apply for letters patent. Williams testified positively that he did not obtain the idea from Rudolph and that he received no aid or suggestion from any person as to how the invention ought to be embodied in a working attachment to a stone saw. Other persons also testified in behalf of Williams; among them was one of Williams' relatives, who gave evidence that Williams told him in July, 1886, how to make a stone saw cut both ways instead of one, and an employee of Williams' testified that Williams, after ordering the improvement attached to the saw, had it removed for fear that some outside party would see it, recognize its value and apply for a patent.

Rudolph is the party in whom interest centers at present, for he was attempting to establish his right to a patent by showing that he conceived the idea of the invention prior to the date of Williams' conception. Rudolph, in making out his case, declared that the idea for a stone saw which would cut both ways presented itself to him on the 26th of October, 1879, while he was paying a visit to a stone yard at Mott Haven, and that it was suggested to him by the operation of a diamond stone saw, which was running there at that time. While there, he said, he made a "little sketch" in lead pencil embodying the device, and he explained the method of its working to a friend who was present and testified in his behalf at the trial. The sketch, however, was not preserved, and Rudolph stated that, while he did not believe that the friend, with whom he had discussed the invention, had understood it, it was very clear in his own mind. Rudolph fixed the date of the making of the invention by reference to a freight slip which was dated Oct. 26, 1879. That was the day upon which his furniture was transported to Peekskill, and Rudolph knew that it was upon that same day that he visited the Mott Haven stone yard. But, unfortunately for the force of his contention, it appeared that the date mentioned fell upon a Sunday and that he could not have received the inspiration exactly as set forth for the further reason that there was no stone saw such as he described in the Mott Haven stone yard at the time. On cross-examination he admitted that he forgot all about his invention after it first occurred to him in 1879 and that it did not come back to him until he was caused to think of it by conversation with Williams. Other evidence was given to bolster up the claim of Rudolph, but it was weak and indifferent. No sketches were introduced in evidence nor was any witness produced who could show that Rudolph conceived, not only of the result to be accomplished, but also of the means of accomplishing it. There was little to establish Rudolph's claim to priority, except his own assertion that he was the first inventor, and it is a familiar rule which requires that but slight weight be attached to testimony where it is coincident with the dictations of self-interest. Under the evidence it was held that Rudolph had not sufficiently established his claim and that he was not entitled to the patent.

When drawings are depended upon to make out a case of priority of conception they must be full and complete and such that any person, skilled in the art to which the invention relates, could construct the device upon referring to the drawings. In Uhlman vs. Arnholdt & Schaefer Brewing Company, 53 Fed. Rep. 485, it was attempted on the part of the defendant to establish priority of conception as a defense to an action for infringement of a patent upon a process of filtering beer. The plaintiff had the patent upon the process, but the defendant claimed that he could show that another party had conceived the idea for filtering beer by the process in suit before the date of the plaintiff's invention. The evidence offered consisted of two letters, with enclosures purporting to describe the invention. Referring to the alleged description in the first letter, the court said: "No person, however skilled, could, from these documents, have gleaned the information requisite for the practice of the method of treatment in question." As to the drawings, which were enclosed in the second letter, the court considered that they would be but of little more assistance to an expert who was desirous of acquainting himself with the details of the process which they were intended to describe. The defendant, being thus unable to show a case of prior conception, was held liable for infringement.

An important and long-contested case, which turned upon the question of the sufficiency of certain drawings, was that of Mergenthaler vs. Scudder, 11 App. Cas. (D. C.) 264. Mergenthaler, it appeared, had filed two applications in the Patent Office for patents upon improvements in linotype machines, one in December, 1890, and the other in May, 1891, and about a year and a half later Scudder filed his application for a patent upon a similar improvement. When the right to the patent be-

came an issue Mergenthaler relied upon the fact that he was the earlier in filing his application, and Scudder sought to base his claim upon the ground that he was the first to conceive the invention and was, therefore, the first inventor and the only one entitled to a patent. The question was carried through the offices of the Board of Examiners and the Commissioner of Patents and an appeal was finally taken to the Court of Appeals of the District of Columbia.

Two questions presented were on the trial of the action: I. Whether prior to the application filed by Mergenthaler there was a complete conception of the invention in issue by Scudder, sufficiently shown in proof. II. Whether Scudder had proven that he proceeded with reasonable diligence to reduce the conception to practical form. The linotype machine, which both inventors had sought to improve, even in 1897, represented the thought of many inventors and was the product of no fewer than 1400 separate patents. It was shown that the original linotype machine was the invention of Mergenthaler, he having been granted patents upon such machines as early as 1885. But Scudder laid claim only to certain improvements on those machines, and it seems that he was employed at a liberal salary as superintendent of the Mergenthaler factory in Brooklyn, and was, therefore, in a position to become acquainted with all the details of construction and operation of linotype machines. As Mergenthaler was first in filing application the burden was upon Scudder to establish by clear proof the priority of his invention. It rested upon Scudder to show a completed invention on his part prior to the filing of Mergenthaler's application. Scudder alleged that he conceived the invention in February, 1889, that he made a disclosure thereof at that time, and had the machine in an experimental form in December, 1889; also that he made drawings in May, 1890, which drawings were produced in evidence. And, as there was no very strong evidence of a conception of the invention prior to May, 1890, the case of Scudder necessarily depended largely, if not entirely, upon the sufficiency of the drawings. The work of embodying the invention in the working machine was done after Mergenthaler had filed his applications, and so could not avail Scudder in his attempt to show prior conception.

In order to establish his right to a patent, it was necessary for Scudder to furnish such full and clear drawings of his invention as would enable any person skilled in the art of construction of such machines to reduce his invention to practical form. This he failed to do. Scudder produced a witness who identified the set of drawings which he had made in May, 1890, and upon which depended his claim to priority. But experts were brought forward by Mergenthaler to testify that there were many details which were not represented on the drawings. And after a very lengthy and searching examination it was determined that the drawings were in many essential particulars deficient and wanting in completeness. It was held that the most that the drawings showed was that, at the time of making them, Scudder had the germ of the idea which, at a time subsequent to the applications of Mergenthaler, matured into the machine upon which Scudder sought a patent. Scudder was declared to have failed to establish a prior conception, and, therefore, was held not to be entitled to a patent.

For a number of apparent reasons, every inventor who desires to obtain a patent upon an invention, should make his application therefor as soon as possible after invention. If the inventor requires time in which to bring his invention to maturity, he may prevent the issuing of an interfering patent, in the meantime, by filing a caveat in the Patent Office. A caveat is a document in which an inventor states the function and the distinguishing characteristics of the invention to which it refers, and prays protection until such time as he can complete his work. The caveat is good only for one year, and while in force its only statutory function is to prevent the issuing of any similar patent to another, until the party filing the caveat has had notice and an opportunity to file an application in his own behalf. An omission to file a caveat does not, of course, impair the ultimate rights of the inventor.

Steel Conduits and Steel Conduit Fittings.

A circular has been issued by the Underwriters' Laboratories, 382 Ohio Street, Chicago, presenting certain questions relating to conduit work and requesting detailed replies from manufacturers, contractors and users of steel conduits. This information is desired in connection with a contemplated revision of underwriters' rules relating to the subject. The questions are as follows:

1. In what respect, if, any, does the ordinary form of enamel on rigid conduit prove an unsatisfactory covering for the steel pipe?

2. Does galvanized rigid conduit possess advantages or disadvantages as compared with enameled conduit? If so, what and for what special uses? (The claim has been made that galvanized pipe in the presence of moisture, especially in concrete, suffers from "local action," that is, a corrosion due to electrical action in the presence of the two metals and traces of acid. Well substantiated evidence of such effects is especially desired if the effect is known to have been observed.)

3. Does the enamel ordinarily used on conduit and fittings (junction, outlet and panel boxes) prevent or render difficult strict compliance with the following rule of the National Electrical Code? If so, what commercially practicable means can be found for obtaining better conductivity?

Rule 25f. Must have the metal of the conduit permanently and effectually grounded. It is essential that the metal of conduit systems be joined so as to afford electrical conductivity sufficient to allow the largest fuse or circuit breaker in the circuit to operate before a dangerous rise in temperature in the conduit system can occur. Conduits and gas pipes must be securely fastened in metal outlet boxes so as to secure good electrical connection. Where boxes used for centers of distribution do not afford good electrical connection, the conduits must be joined around them by suitable bond wires. Where sections of metal conduit are installed without being fastened to the metal structure of buildings or grounded metal piping, they must be bonded together and joined to a permanent and efficient ground connection.

(At the meeting of the Underwriters' National Electrical Association in March, 1907, it was suggested that the following be added as a fine print note in Rules 24A, 25d, 25f, of the Code: "It is recommended that galvanized cables, outlet boxes and fittings be used in order to secure a better electrical contact at all points throughout the cable system." It was also suggested that a note be added to Rule 49Ab to read: "It is recommended that the protective coating (of switch and outlet boxes) be of metal such as tin or zinc." These suggestions were referred to a special committee for consideration and report.)

4. Definite information is desired as to the use of conduit in cement or concrete.

(a) Conditions liable to cause deterioration of conduit, either rigid or flexible in cement or concrete. See also inquiry No. 2, above.

(b) Do flexible conduits or armored cables placed in wet concrete admit water to the interior while concrete is setting to a degree sufficient to cause trouble? If so, what precautions should be taken or what limitations should be placed to such use of flexible conduit or armored cables?

5. What injurious effects on exposed conduits are observed from the action of acid fumes and gases. In such cases what may be done to protect the conduits from rapid deterioration?

6. What added specifications for construction and installation of junction boxes should be made? See Code Rule 49A, which treats of switch and outlet boxes, and Rule 25b and g.

7. What defects, if any, are found in present types of

(a) Ordinary conduit outlet boxes?

(b) Junction boxes?

(c) Grounding clamps?

(d) Fittings for use with flexible conduit and armored cables?

(e) Fittings for use with exposed rigid conduit such as "condulets" and similar devices?

8. What other defects, not suggested above, have been noted in present forms of conduit or fittings? What means may be taken to correct such defects and what additions or revisions of the present Code rules on conduit are desirable?

Cost of Generating Electricity by Small Gas Producer Plants.

In the 1907 "Question Box" of the Canadian Electrical Association some interesting figures on the cost of energy from a 100-hp gas producer plant were given by Mr. N. P. Edwards, of Edmonton, Alberta. Anthracite coal with a calorific value of 12,000 B. t. u. was assumed, costing $5 per ton in pea size. The producer efficiency was 78 per cent. The first cost of a 100-hp suction gas producer, engine and compressed air starter, together with erection and foundations, was taken at $7,000. The attendance for a plant of this size is small if the plant is properly equipped, an allowance of four hours per day being ample, according to Mr. Edwards. From the experience of the contributor the following figures were taken:

A 100 b. h. p. consumes 1 lb. of coal per hp-hour, or 1000 lbs. per 10 hours, and the stand-by losses of the other 14 hours will not amount to more than 30 lbs.; hence the fuel was taken at 1030 lbs.

OPERATING COST.

Engineer at 25 cts. per hour, 300 days (4 hrs. each)	$300.00
Coal at $5.00 per ton, 154.5 tons	773.00
Oil and waste	230.00
Interest on investment at 8 per cent	560.00
Depreciation at 8 per cent	560.00
Insurance, repairs, taxes	250.00
Total	$2,673.00
Per hp year	$26.73

Load factor, 100 per cent.

To this must be added the cost of water used to cool the engine and that used in the scrubber, 4.5 gals. per hp-hour; the water used in cooling the cylinder can be used over again if cooling tanks are employed; the allowance for the scrubber and vaporizer is 3 gals. It is inadvisable to use again the water that has passed through the scrubber and been purified, because if there is a large percentage of sulphur in the coal, the sulphurous acid generated in the producer acts on the wrought iron of the scrubber. Repairs to the producer consist of removing the firebrick lining, once a year as a minimum, and sometimes once in three years. The coke in the scrubber requires removal about twice a year.

Mr. J. E. Ashworth, of Moose Jaw, Assiniboia, gave the following figures for a 100-hp plant, not including fixed charges:

Fuel, 125 lbs., per hour (anthracite, $7.00 per ton)	.44
Labor, 1 man at $3 per day	.30
Oil and waste	.05
Operating cost per hour for 100 hp	.79
Operating cost per year, 300 hrs., per hp	$23.70

These figures represent brake horse-power and not electrical output.

Switchboard Wire Protection.

By T. W. Poppe.

When connecting the feeders and dynamo and service leads to a switchboard, a very neat and durable job can be made by serving the wires with marlin. By serving is meant to tightly wrap the wires of each set (two or three as the system may require) together with marlin. It should be commenced where the wires leave the conduit and continued to within five or six inches of the first lug it will connect with. Here the wires can be separated and continued to their respective lugs. When the serving is complete on one set of wires the marlin should be thoroughly painted with a moisture-resisting compound. The marlin serving will stiffen the wires and they can be bent very neatly to avoid touching the bus-bars of the board. When painted the marlin hardens so that it is difficult to bend the wires after the paint has dried. It then requires a strong pressure to bend them. The marlin acts as an additional insulation and mechanical protection to the wires, and while no harm would result from the wires coming in contact with the bars while thus protected, it looks better to bend them so as to avoid touching the bars.

The sailors when serving a rope or other object use a peculiar serving tool, but a wireman can construct one of wood, using a piece of oak 2 ins. wide, ⅞ in. thick and 14 ins. long. Fig. 1 shows a tool similar to one used by the writer. It is made of oak as explained, having four holes drilled through

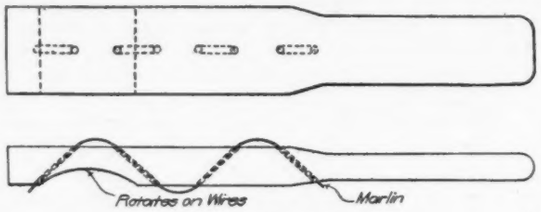


FIG. 1.—SERVING TOOL.

it, as shown. The marlin is passed through the holes, as shown, commencing at the hole nearest the handle. The object of this is to cause a strain on the marlin at the point where it passes around the wire, so that the marlin may be wrapped tightly. The friction caused by the marlin passing through the holes causes the strain. It is necessary to serve the first four

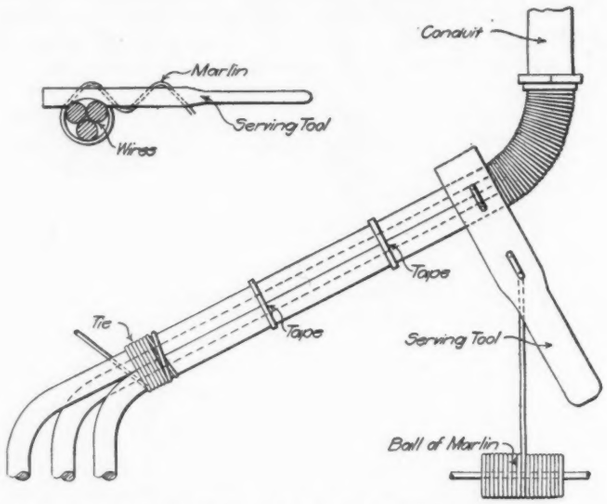


FIG. 2.—APPLICATION OF MARLIN AND SERVING TOOL.

or five inches by hand, pushing the winding into the conduit as far as possible. This acts as an additional protection to the wires where they leave the conduit. This protection should be afforded, as there is more or less wear on the insulation during the process of serving and bending. The serving is continued to within four or five inches of the first lug by means of the serving tool. The wires are then bent in shape, as

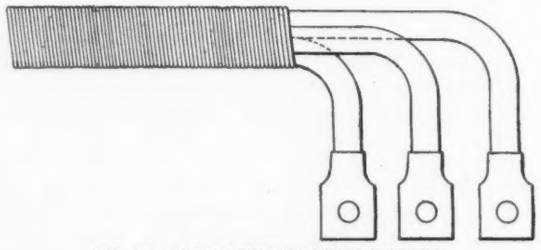


FIG. 3.—CABLES WOUND WITH MARLIN.

shown in Fig. 3, Fig. 2 showing the serving of the wires. While serving it is necessary to pass the ball of marlin around the wires with the serving tool.

To serve the wires properly it is necessary to tie the ends of the wires taut. The wires should be straightened and run together so as to be parallel, being bound with tape at different points to keep them so. As the serving progresses the tape

should be removed, as it will cause a bulky appearance in the marlin if left on. The serving should be continued to a point longer than absolutely necessary at first to avoid a short measurement in it, due to the extra length of wire the bending will require. When it is thus finished the wires can be bent into their permanent position and the marlin removed to the proper point.

The neatest way to bind the serving is to leave three or four windings loose, allow an extra foot of marlin, remove the serving tool and push the end of the marlin under the loose windings, bringing it out between the fourth and fifth winding and rubbing the marlin in the direction of the serving so as to tighten the loose windings; then pull the end of the marlin projecting through the fourth and fifth winding taut. The surplus marlin may be cut off and tucked into the serving by being pushed under the marlin between two wires. This leaves a very neat ending. Each set of wires should be painted as soon as bent into position, as each set finished makes it more difficult to paint the others. The room on a switchboard as a rule is limited and does not admit of much space between the wires. Should some paint drop on the bus-bars during the painting process, it can be removed by using a piece of waste soaked with kerosene oil.

Wiring and Connections for Constant Potential Transformers.

BY GEO. A. BURNHAM.

The principal mechanical features on a transformer are embodied in the cores, arrangement of coils, and the transformer case with its various details. Mechanically considered, transformers may be divided into two distinct classes, namely, the core-type and the shell-type. Although the electrical principles involved are the same in the two types, they differ radically in mechanical construction. Fig. 1 is a sketch of a core-type transformer, the magnetic circuit of which consists essentially of two cores *a a*, and two yokes *b b*, which when arranged as shown in the sketch form a complete magnetic circuit. These cores are made, or "built up," of laminated stamping which vary according to different designers, from .012 to .016 of an inch in thickness. It is quite evident that a solid iron or steel core could not be used in an efficient transformer on account of the excessive eddy current loss. To limit the value of eddy currents, the iron is placed in the form of thin sheets laid transverse to the path of the eddy currents, and are insulated from one another by sheets of paper, or a thin coat of varnish. Some makers, however, depend solely upon the oxide which forms upon the surface of the lamina for insulation. The latter arrangement provides a more compact core, and requires less constructive material for given conditions. The insulation of the laminae in the above manner confines small portions of the eddy current to one sheet, which being comparatively thin, offers considerable resistance, and thus the current is practically reduced to zero. As a matter of fact, the loss due to eddy current in a modern transformer is fairly small, indeed.

The iron for "building up" the transformer cores is very carefully selected and is subjected to an annealing process which reduces "aging" to a minimum. This aging of the iron is a phenomenon which takes place in the molecules of the iron, and is attributable to the high temperature to which the core is subjected. The "aging" has a tendency to increase the core losses, and it varies with the length of time through which the transformer has been operated. The magnetic circuit for both the shell-type and core-type transformers is made in such a manner that the joints are broken or interlocked. This mode of construction makes a very efficient and compact core, reduces the reluctance to a minimum and prevents excessive vibration and humming, which otherwise might cause serious injury to the insulation of the wires.

After the cores of small transformers have been assembled they are sometimes covered with a layer of heavy fibrous material much like heavy wrapping paper. After this insulating material has been thoroughly dried, the coils are placed on the cores as shown in Fig. 1. The secondary, which consists of a comparatively few turns of heavy wire, is placed next to the cores as shown in Fig. 1. The secondary, which consists breaking down the insulation to the iron core than there would be if the primary winding, which is subjected to the high voltage, had been placed adjacent to the core. After the secondary winding has been properly insulated, a mica or micanite shield is placed over it; the primary, which consists of a comparatively larger number of turns, is wound over this. In some instances the coils are divided into sections; that is, a secondary coil is between two primary coils arranged alternately along the core. With this method the demagnetizing effects of the secondary coil are split up and the magnetic leakage is much reduced. This method, however, means more space employed for insulation and a complexity of connections, but, on the other hand, the voltage between adjacent layers is considerably less than with the arrangement of coils shown in Fig. 1.

Assume that the primary of the transformer indicated in Fig. 1 has 900 turns, made up of 30 layers, and the primary is to operate at 2000 volts. There will be a difference of potential of 2.2 volts between adjacent convolutions and about 130 volts difference of potential between the ends of adjacent layers. From this it may be seen that some care is necessary in providing for sufficient insulation between the adjacent layers. Oiled silk is generally used for this purpose.

The ends of the primary coils are generally joined to a terminal block, located at the top of the core and thoroughly

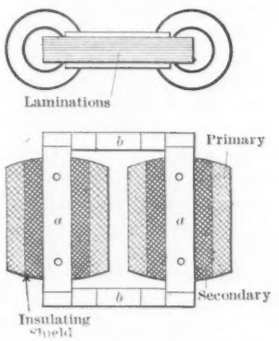


FIG. 1.—COILS AND CORE OF A CORE-TYPE TRANSFORMER.

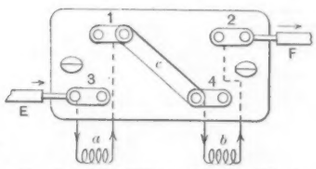


FIG. 2.—TERMINAL BOARD OF A TRANSFORMER HAVING TWO PRIMARY COILS.

insulated from the iron structure of the transformer. The block is usually made of porcelain attached to a piece of well-seasoned, especially prepared oak, which, in turn, is fastened to the iron frame which holds the core in place.

Fig. 2 shows a connection block used by one of the large manufacturing companies. One, 2, 3 and 4 are brass terminals to which the ends of the primary coils *a* and *b* are connected. It will be noted that the brass straps *C*, in the position shown, connect the two coils *a* and *b* in series, but should the two straps *c* (one on top of the other) be removed from the terminal 1 and 4 and one be connected between 1 and 2 and one from 3 to 4, the two coils *a* and *b* would be connected in parallel. By this arrangement the primary may be operated at either 1000 or 2000 volts. The leads *E* and *T*, which connect to the line, pass through the transformer case by way of porcelain bushings which are securely fastened into receptacles with an insulating cement; in many instances a form of resinous wax is used.

The secondaries terminals, in many instances, pass to the outside of the case in the same manner as do the primaries, and the series or parallel connections may be made when they are joined to the external circuit.

A complete section of a core-type transformer with the coils immersed in cooling oil is shown in Fig. 3.

SHELL-TYPE TRANSFORMERS.

The construction of the shell-type transformer differs widely from that of the core-type. In the core-type there is only one

magnetic circuit, but in the shell-type there are two, as shown by the arrows in Fig. 4. These cores are made or "built up" in the same manner as are those of the core-type. The coils, however, are put on in an entirely different manner. They are form-wound and thoroughly insulated, and then the core is built up around them and then pressed tightly together and held in place by two cast-iron end plates with several through bolts.

Instead of there being few coils and many layers as in the core-type, there are many coils and many layers per coil. The coils are made flaring at the top so that the oil can circulate through

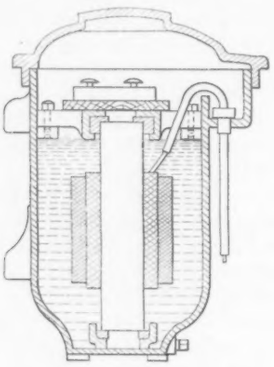


FIG. 3.—CROSS-SECTION OF AN OIL-INSULATED TRANSFORMER.

them easily. This method of construction permits the use of deep, narrow coils, with many layers and few turns per layer, consequently the voltage between adjacent layers is low and there is less liability to a short-circuit. The spreading of the coils at the end above the iron core provides a large radiating surface, and allows each coil to radiate its own heat directly. Thus there is uniform heating throughout and consequently no excessive strains are produced on the insulation. The greater part of the iron is placed on the outside where it can easily dispose of its heat and thus reduce in a measure the tendency towards aging.

The sub-division of the windings into many coils allows the full output to be obtained at several different voltages, as the coils may be connected into many different series and parallel arrangements.

Fig. 6 is a diagrammatic sketch of the terminal block indicated in Fig. 5, to which the ends of the various coils are connected. The arrangement shown is used to a great extent in the transformers built by one of the large manufacturing companies.

The primary winding consists of two coils, each having a tap brought out and joined to a post on the terminal block. The number of turns between the tap and the end of the coil is about 5 per cent of the total number of turns per coil. By this arrangement the turns on the primary may be increased by 5 per cent by connecting to the tap instead of to the

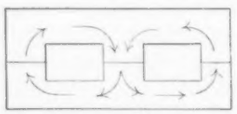


FIG. 4.—MAGNETIC CIRCUITS OF A SHELL-TYPE TRANSFORMER.

end of the coil; by connecting to the two taps instead of to the end of the coils, the turns may be decreased by 10 per cent, thereby producing an increase in the secondary voltage of 5.2 per cent or 11.1 per cent, respectively.

The secondary winding is composed of four coils, the ends of which are joined to the terminal block where various parallel and series connections can be made. The diagram shows two of the sets of coils connected in series; the four coils being connected in series, four times the voltage of one of the coils is available between the two outer terminals. The coils, however, could have been connected in multiple if the strap had been connected as follows: From 1 to 2, 3 to 4, 5 to 6, and 7 to 8. By the latter arrangement *c* and *d* would have been connected in parallel and *c'* and *d'* in parallel. These pair of coils in turn could have been joined either in parallel or in series by the external connections.

After the connections between the coils and the terminal block have been thoroughly made and soldered to meet the required conditions, the coils assembled on their cores are placed in the transformer case as shown in Fig. 3. These cases are usually of cast iron provided with removable covers held in place by heavy thumb screws. The cases of the larger transformers, however, are frequently made of boiler iron. One of the necessary features of a transformer is that its temperature be main-

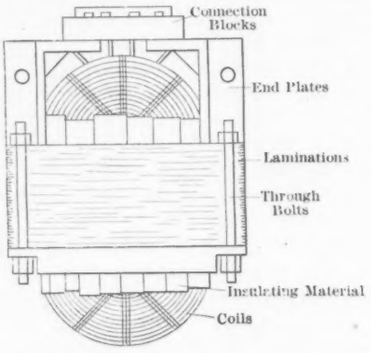


FIG. 5.—COILS AND CORE OF A SHELL-TYPE TRANSFORMER.

tained as low as possible. Many of the small transformers are cooled by a natural circulation of air, because comparatively little heat has to be radiated, but in larger transformers the heating becomes an important factor. Self-cooled transformers are those which require no artificial means for dissipating the heat emitted from the apparatus during operation. These transformers may be divided into two types, namely, air-cooled and oil-cooled. The air-cooled or natural draft transformer is one in which air is used to absorb the heat, which is done by designing the transformer so that a draft of air may readily pass through it. Air-cooled transformers, if used out of doors, have the disadvantage that they require specially shaped cases to keep out the rain, and the insulation can readily absorb moisture.

Oil-cooled transformers are those in which the coils and

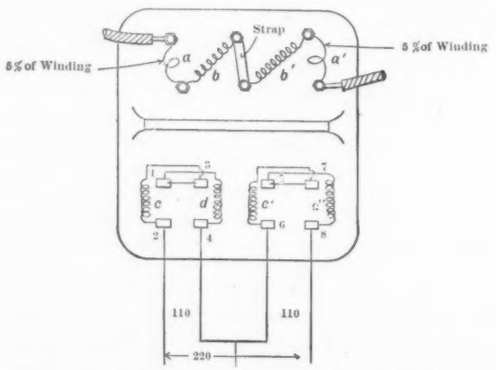


FIG. 6.—TERMINAL BLOCK OF A TRANSFORMER HAVING TWO PRIMARY AND FOUR SECONDARY COILS.

cores are submerged in oil. The oil serves two purposes; it conducts the heat from the coils and cores to the iron case, from which it is radiated, and it serves as an insulator. Frequently lightning discharges rupture the insulation, and the oil flows into the rupture and repairs it, providing the rupture is small.

There is, as a general rule, sufficient space within the case to allow oil to circulate freely, due to connection. The oil on being heated rises to the top, and the warm oil at the top and sides of the case, as it becomes cool, sinks to the bottom. The cases are generally corrugated so as to present a greater surface to dissipate the heat.

In many instances where the transformers are made in such large size that there is not sufficient area to dissipate the heat, artificial means must be resorted to. Generally one of the following methods is adopted: Forced-oil, water, or air circulation.

In the forced-oil circulation type, the oil is pumped from the case and forced to circulate through coils of pipe so that it may dissipate its heat readily, after which it is returned to the case.

In the case of the forced-water circulation, a coil of pipe is submerged in the oil which surrounds the coils and cores. Through this coil of pipe water is pumped. This method has some advantages over the the forced-oil in that it requires less power to force the water than the oil, and, whereas in the forced-oil a cooling arrangement is used, such arrangement is generally dispensed with in this latter type. There is one danger, however, in that the water pipes are liable to break, thereby allowing water to come in contact with the insulation which might cause serious damage.

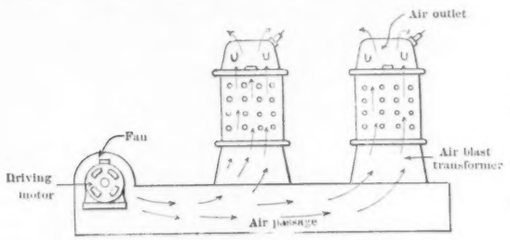


FIG. 7.—AIR-BLAST TRANSFORMERS.

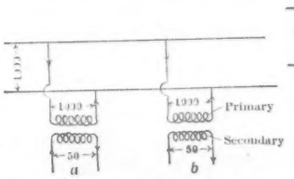


FIG. 8.—INDEPENDENT CONNECTIONS OF TWO TRANSFORMERS.

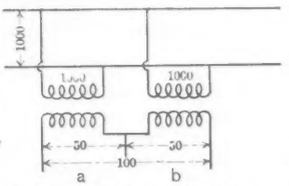


FIG. 9.—THREE-WIRE CONNECTION OF TRANSFORMER SECONDARIES.

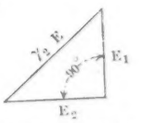


FIG. 12.—VECTOR RELATIONS OF TWO-PHASE E. M. F.'S.

ELECTRICAL CONNECTIONS.

The primary and secondary windings of transformers may be variously connected to meet different requirements. Fig. 8 represents the ordinary method of connecting transformers to constant potential mains, the two transformers *a* and *b* consisting simply of a single primary and secondary. The primaries are connected in parallel to a 1000-volt main and, with a transformation ratio of 20 to 1, will produce 50 volts at the secondary terminal. Fig. 9 shows the same transformers with their secondaries so connected as to obtain an e. m. f. of 100 volts.

In many instances it is necessary to arrange several transformers to feed into the same line, and great care must be taken to get the corresponding terminals of each transformer connected to the same side of the mains. In many instances it is deemed advisable to operate a three-wire circuit from the secondaries of transformers, and thereby reduce the cost of copper for the feeders. By joining the two secondaries in series and connecting the neutral wire to their junction as shown in Fig. 9. this condition can be obtained. This method of connecting is used very extensively.

For polyphase distribution ordinary single-phase transformers are used, although special transformers are made for both two-phase and three-phase distribution. Fig. 10 shows the ordinary two-phase distribution using single-phase transformers and delivering two distinct currents from the secondaries. It is sometimes desirable to operate a three-wire, two-phase secondary distribution as shown in Fig. 11. It may be noticed that the voltage across the outside wire on this three-wire system is different from that of Fig. 9, in that here the e. m. f. is 141 volts instead of 200 between the outside wires. This result is due to the difference in time-phase of the e. m. f.s; they differ by 90 time-degrees, so that instead of adding the two secondary voltages numerically, they must be added vectorially.

Referring to Fig. 12 let E_1 represent the secondary voltage of phase winding *A* and E_2 the secondary voltage, of phase winding *B*, which voltages are displaced by 90 time-degrees. From geometry the third side equals $\sqrt{E_1^2 + E_2^2}$ and since $E_1 = E_2$ the third side, or resultant, equals $\sqrt{2}\,E_1$ or $\sqrt{2}\,E_2$ or 1.41 *E*, *E* being the voltage of one phase. Transformers in two-phase work are frequently interconnected as shown in Fig. 13, where instead of there being 4000 volts between the two outside wires, the e. m. f. is 2828 volts.

In two-phase combinations, two transformers are required, whereas in three-phase distribution three separate transformers are generally employed. There are in general use two distinct methods of connecting three-phase transformers, namely, the star (or Y) connection and the delta (or △) connection. Fig. 14 shows the star connection for both the secondary and the primary coils.

The combination is made up of three separate single-phase transformers, the primaries of which are represented by the letters *a*, *b* and *c*, and the secondaries are indicated by the letters *a'*, *b'* and *c'*. It is evident from Fig. 14 that one end of each primary is connected to a common point called the "neutral," and the other three ends are connected to the three primary lines. The secondaries are connected in exactly the same manner with respect to the neutral point and the three other ends are connected to the load circuit. The voltage between wires is easily explained by reference to Fig. 15. Let *oa*, *ob* and *oc* represent the secondary e. m. f.s of the three transformers shown in Fig. 15. The point *o* may be considered the neutral and *a*, *b* and *c* the relative e. m. f.s of the three ends of the secondaries which connect to the load circuit. Now the turns of wire in the three legs are equal in number and the e. m. f.s in the three-phase circuit are displaced by 120 time-degrees. From this condition the sides, *ab*, *bc* and *ca* are equal and the time-phase displacement between the e. m. f.s is 120 degs., as shown.

The delta connection differs radically from the star con-

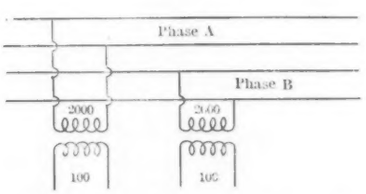


FIG. 10.—INDEPENDENT TWO-PHASE CONNECTIONS.

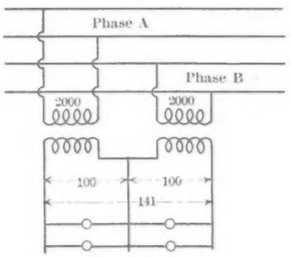


FIG. 11.—THREE-WIRE TWO-PHASE CONNECTIONS.

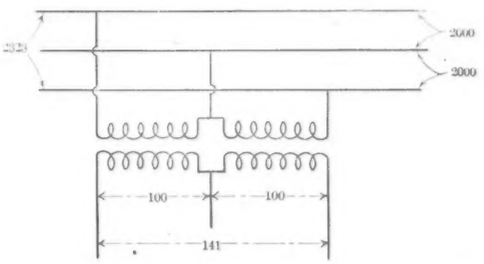


FIG. 13.—THREE-WIRE PRIMARY AND SECONDARY CONNECTIONS, TWO-PHASE.

nection, although both attain the same end. Fig. 16 shows the delta connection; instead of the primary coils having a common neutral the primaries of the three transformers *a*, *b* and *c* are connected in series and a lead is connected at each junction of two coils. The secondaries are connected in a similar manner. The voltages in this type of connection evidently are

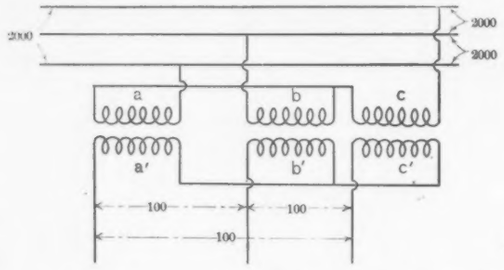


FIG. 14.—STAR-CONNECTED TRANSFORMERS.

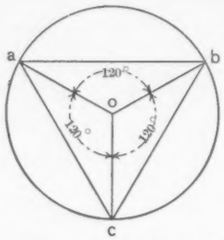


FIG. 15.—VECTOR RELATION OF VOLTAGES IN STAR-CONNECTION.

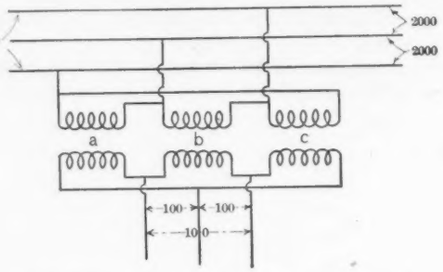


FIG. 16.—DELTA-CONNECTED TRANSFORMERS.

equal, because there is a constant ratio between the primary and the secondary voltage of each transformer.

In the last two cases of three-phase connections arrangements in which the primary and secondary were both connected in the same manner have been considered. The next case to consider is one in which the primary is connected star and the secondary connected delta. Fig. 17 shows this combination, *a*, *b* and *c* are three standard transformers having a ratio of 10: 1. The

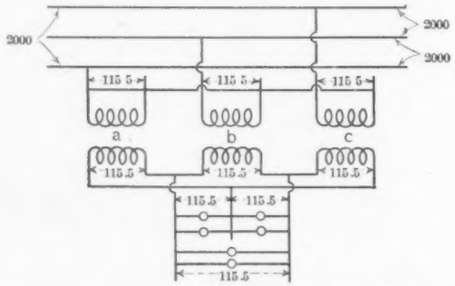


FIG. 17.—STAR PRIMARY AND DELTA SECONDARY CONNECTIONS.

primaries are connected in star, and an e. m. f. of 2000 volts is impressed across two legs in series. Thus there is an e. m. f. of 1155 volts impressed on each of the primary coils, as will be seen by referring to Fig. 18. Let *ao* and *oc* represent two of the legs of the star connection having impressed on them 2000 volts, represented by the line *ac*. Now the triangle *aoc* is one having an angle of 120 degs. included between its two equal sides, *ao*

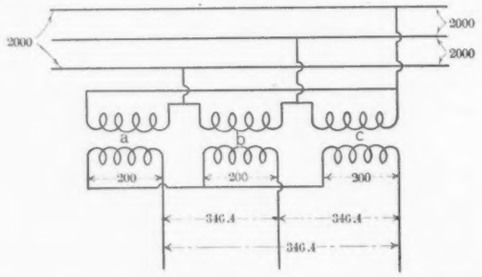


FIG. 19.—DELTA PRIMARY AND STAR SECONDARY CONNECTIONS.

and *oc*. Let fall from *oa* a perpendicular *ob* which bisects the line *ac*. Now the lines *ab* and *bc* represent 1000 volts, each.

From trigonometry the sine of the angle $boc = \frac{bc}{oc}$, or sine

$$60 \text{ degs.} = \frac{1000}{oc} = \frac{\sqrt{3}}{4} \text{ or } oc = \frac{2}{\sqrt{3}} 1000 = 1155.$$

Here there is an e. m. f. of 1155 volts impressed on the primary of each transformer. Since the transformer secondaries are connected in delta and have a ratio of 10: 1 the secondary voltage will be 115.5 volts, as indicated in Fig. 19.

Consider now the reverse combination; that is, instead of having a star-connected primary and a delta-connected secondary, consider a delta-connected primary and a star-connected secondary. Fig. 19 illustrates this arrangement. Assume the same type of transformers is used as in the previous case. Now, as the primaries are connected in delta there will be 2000 volts impressed on each primary and since the ratio is 10: 1, there will be 200 volts generated in the secondary of each transformer. The secondary windings are connected in star so that the e. m. f. at the secondary terminals of the transformers will be 346.4 volts. The following is an explanation of the increase in terminal voltage over the individual voltage of the separate secondaries.

The lines *oa*, *ob* and *oc* in Fig. 20 represent the time-phase

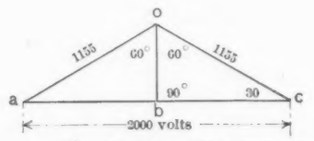


FIG. 18.—VECTOR RELATION OF VOLTAGES IN STAR CONNECTION.

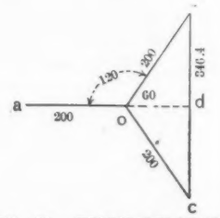


FIG. 20.—VECTOR RELATION OF VOLTAGES IN STAR CONNECTION.

displacement and value of the voltages at the secondaries of the transformers. Now *oc* and *ob* represent 200 volts each, and have included between them an angle of 120 degs. The third side of the triangle *obs* is then formed to be $200\sqrt{3} = 346.4$ volts.

Symbols for Wiring Plans.

On the opposite page we reproduce, by the permission of the National Electrical Contractors' Association of the United States, the chart of standard symbols for wiring plans as adopted by that Association, the American Institute of Architects, the U. S. Supervising Architect's office, U. S. Army Quartermaster-General's Office, as well as by several municipal departments, many technical institutions, prominent architects and engineers.

Since the first edition of the chart there has been a change in the symbols for center and bracket outlets, and symbols for indicating "gas only" outlets have been added. Also under the heading "Suggestions," standard heights of wall outlets have been enumerated. These changes and additions were made at the instance of the American Institute of Architects.

Copies of the chart and of sheets for attachment to specifications may be had of the Secretary of the National Electrical Contractors' Association, Utica, N. Y., or the Secretary of the American Institute of Architects, the Octagon, Washington, D. C., at the following cost prices: Wall hangers, 10 cents each. Large quantities, special prices. Specification sheets, lots of 100, $1.25 per hundred. Less than 100, 1½ cents each. There are two specification sheets, one relating to electric light wiring and the other to telephone and bell wiring.

STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION OF THE UNITED STATES and THE AMERICAN INSTITUTE OF ARCHITECTS.

Copies may be had on application to the Sec'y of The Nat. Elec. Cont. Associ'n, Utica, N. Y., and the Sec'y of The American Instit. of Architects, Washington, D. C.

(4) Ceiling Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

4/2 Ceiling Outlet; Combination. 4/2 indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only ●

(2) Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

4/2 Bracket Outlet; Combination. 4/2 indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only ●

2 Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

4 Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

6 Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Stand. 16 C. P. Incan. Lamps.

6/6 Outlet for Outdoor Standard or Pedestal; Combination. 6/6 indicates 6-16 C. P. Stand. Incan. Lamps; 6 Gas Burners.

D Drop Cord Outlet.

⊗ One Light Outlet, for Lamp Receptacle.

◑ Arc Lamp Outlet.

Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.

Ceiling Fan Outlet.

S^1 S. P. Switch Outlet.

S^2 D. P. Switch Outlet.

S^3 3-Way Switch Outlet.

S^4 4-Way Switch Outlet.

S^D Automatic Door Switch Outlet.

S^E Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus; S^1 XII; meaning 12 Single Pole Switches.

Describe Type of Switch in Specifications, that is, Flush or Surface, Push Button or Snap,

Meter Outlet.

Distribution Panel.

Junction or Pull Box.

(5) Motor Outlet: Numeral in center indicates Horse Power.

Motor Control Outlet.

Transformer.

——— Main or Feeder run concealed under Floor.

——— Main or Feeder run concealed under Floor above.

– – – – – Main or Feeder run exposed.

——— Branch Circuit run concealed under Floor.

——— Branch Circuit run concealed under Floor above.

– – – – – Branch Circuit run exposed.

–●–●– Pole Line.

● Riser.

Telephone Outlet; Private Service.

Telephone Outlet; Public Service.

Bell Outlet.

Buzzer Outlet.

2 Push Button Outlet; Numeral indicates number of Pushes.

(8) Annunciator; Numeral indicates number of Points.

Speaking Tube.

(C) Watchman Clock Outlet.

Watchman Station Outlet.

(TC) Master Time Clock Outlet.

Secondary Time Clock Outlet.

Door Opener.

Special Outlet; for Signal Systems, as described in Specifications.

Battery Outlet.

——— Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

——·——·—— Circuit for Clock, Telephone, Bell or other Service, run under Floor above, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

NOTE—If other than Standard 16 C. P. Incandescent lamps are desired, Specifications should describe capacity of Lamp to be used.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

Heights of Centre of Wall Outlets (unless otherwise specified)

Living Rooms	5′ 6″
Chambers	5′ 0″
Offices	6′ 0″
Corridors	6′ 3″

Height of Switches (unless otherwise specified) 4′ 0″

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Boiler Room Economies.

By James Smith.

One of the ever-present problems in central-station operation is the delivery of the kw-hour of electrical energy at the busbars with the minimum consumption of fuel, and so far as the operating engineer is concerned, this problem is the most difficult of solution, while at the same time yielding a return for any conscientious time expended on it. Before the problem can be dealt with properly, it is necessary to have some record of the units generated, together with the coal and water used, and in most stations these data are easily procurable. The losses that are taking place should then be sought out and an endeavor made to find whether they are due to low boiler efficiency, steam losses, excessive steam consumption, etc. If a station is being operated with very great losses, wonders may be worked in a short time; but not many stations are being thus operated, so that increased economy is obtained gradually and only after a careful study of conditions. Much time is also required for making tests and determining whether a certain performance can be bettered; and, inasmuch as the average engineer has not many leisure moments to devote to such work, it may be weeks before these preliminary matters have been cleared up. The subject may be divided for convenience into the following headings: Fuel analysis, fuel gas analysis, auxiliary apparatus, feed water, firing, superheating, load factor and radiation.

It is essential for obtaining the best results that a straight run of coal should be used, as nothing is so inimical to economical steam generation as the frequent changing of the quality of coal. Firemen, if supplied with a certain line of coal, can in time learn to burn this to the best advantage. A carload of coal from one mine and a carload of coal from an entirely different mine should not be the rule for purchasing fuel. Coal from one mine should be used if good results are to be expected from the average fireman.

The quality of the coal should also be ascertained by repeated tests on carload lots. Not infrequently one finds a station buying the cheapest slack on the market, presumably on the assumption that any deviation in the quality of the fuel will be in its favor. Calorimetric tests of small quantities of coal, while offering some basis of comparison, are not of great commercial value, since the value of bituminous coal, for instance, is augmented by the hydrocarbons contained in it, and a large proportion of this escapes up the chimney without giving up its heat. Evaporative tests under similar conditions yield the best practical results.

In order to make a complete analysis of the gases from a boiler, the temperature, draft and chemical constituents should be known. By means of this information, the chimney losses may be reduced to a minimum, and apparatus for determining these points is available on the market. To obtain the maximum efficiency, the quantity of excess air must be as small as possible, and this quantity can only be determined by individual tests, and depends upon the quality of the fuel and also on the available draft. As much oxygen as possible should be combined with the carbon to produce carbon dioxide. For all practical purposes, the amount of carbon dioxide produced is an index to the state of combustion. Theoretically, without excessive air, 19 per cent of carbon dioxide will be produced; but in everyday work one might with reasonable attention obtain 12 per cent, with an exit stack temperature of 600 degs. F. Many stations are equipped with recording apparatus for ascertaining this percentage, and in most cases satisfactory results are obtained that have justified the original outlay. Without some such apparatus it is not possible to keep a close watch on air-leakages. Many boiler settings are notoriously porous, and being subjected to great changes of temperature, the air-leakage becomes excessive unless constant attention is directed to its restriction. Air leakages, unlike steam leakages, do not show themselves, as the leakage in the first case is from without, whereas the leakage in the latter case is from within.

When boilers are shut down under natural draft, there is always air leakage in the main flue, even though the dampers are closed. The brickwork around damper frames will generally be found to allow considerable air to pass through. This air has a cooling effect on the chimney gases and decreases the draft. If economizers are used, it also means that their efficiency is lowered. Unless all such leaks are stopped, any recording carbon dioxide apparatus is of little use.

The auxiliary apparatus consists of stokers, coil-handling apparatus, feed pumps, condenser equipment, etc., etc. The stokers, coal and ash conveyors, etc., should, as a general rule, be electrically driven, since steam engines for this purpose are inefficient. The question of electrically-driven or steam-driven feed-water pumps is open for discussion. If an electrically-driven pump is installed because of its higher efficiency, a steam-driven pump should be provided as a stand-by in the event of any failure of the electric supply.

Feed-water purification may or may not be essential, but feed-water heating is important. Many engineers have an erroneous opinion as to the detrimental effects of scale in boilers. While scale does not materially reduce the efficiency of a boiler, it may increase the wear and reduce its life. The steam-making power of a boiler-plate depends not on its conducting powers, but on its receiving and transmitting powers. An iron plate can conduct 12 times as much heat as it can absorb from the fire or give up to the water, and it is quite possible that a thin coat of scale on the metal in the water and a deposit of soot on the metal in the heated gases may be a benefit rather than a detriment. The nature of the scale is, of course, important, and unless it is many times as bad a conductor as the iron, the same amount of heat will pass, so that the question resolves itself into its ability of handing over the heat received to the water. A thin scale is preferred by many experienced engineers, who hold that this scale not only stops corrosion and pitting, but makes the boiler steam better. If, however, much scale-forming material is present in the water, this should be removed before the water is fed to the boilers. In every case where water is treated, the treatment should be done external to the boiler, since it is the function of the boiler to raise steam and not to act as a purifier.

When the engineer has checked all the leakages in the brickwork, has affixed gauges to the stack so as to record the amount of carbon dioxide present, and has done all that possibly can be foreseen to effect economy, the problem then must naturally rest with the fireman. The latter should be instructed in the proper method of firing the particular fuel used, and so much has been written on this subject that it would appear that advantage could be taken of the abundant material available.

By means of superheated steam, a saving of from 10 to 20 per cent may be effected in the fuel expense, the greater saving being realized when the engines are working under uneconomical conditions or where the steam pipe lines are very long. While a superheater may reduce the efficiency of a boiler somewhat, the saving in steam more than offsets this loss of efficiency; so that if superheated steam requires 10 per cent additional heat and reduces the engine losses by 20 per cent, a material saving is effected.

The station with a large output and high-load factor naturally shows better economy as to fuel consumption. If the output of a station is below normal, the conditions are not conducive to economy. If the load factor is such as to require banked fires in the boiler room, an effort should be made to improve the load factor. The effect of a bad load factor is more pronounced in the boiler room than in the engine room, since a standing engine does not waste coal, but a banked fire does. The number of boilers under steam should, therefore, be kept down to a minimum and some method of increasing the draft installed to help out at peak loads.

Radiation from all sources should be reduced by covering all heat-radiating surfaces with non-conductors. Nearly all stations have their live steam pipes enclosed in some steam pipe covering, but not all heat-radiating surfaces are covered, so that economy in this direction is only partially obtained.

LETTERS ON PRACTICAL SUBJECTS.

BANDING REPAIRS.

The use of bands on direct-current armatures is always essential where the peripheral speed is much beyond 2500 ft. per minute. In the case of repairs to such armatures, the replacing of bands is the last operation to put them in running shape again, and is usually considered quite a simple matter. This is especially true in the smaller sizes of motors or generators, as the armature may be readily transported to a lathe where this work can be done very speedily; and numerous instances can be cited, where, in the absence of a lathe, the armature was rotated by hand in a set of wooden supports or bearings by fastening a suitable crank on the shaft.

Engine-type generators of 125 and 250 volts often do not require bands when the same generator wound for 550 volts will require them, because the cross-section of the armature

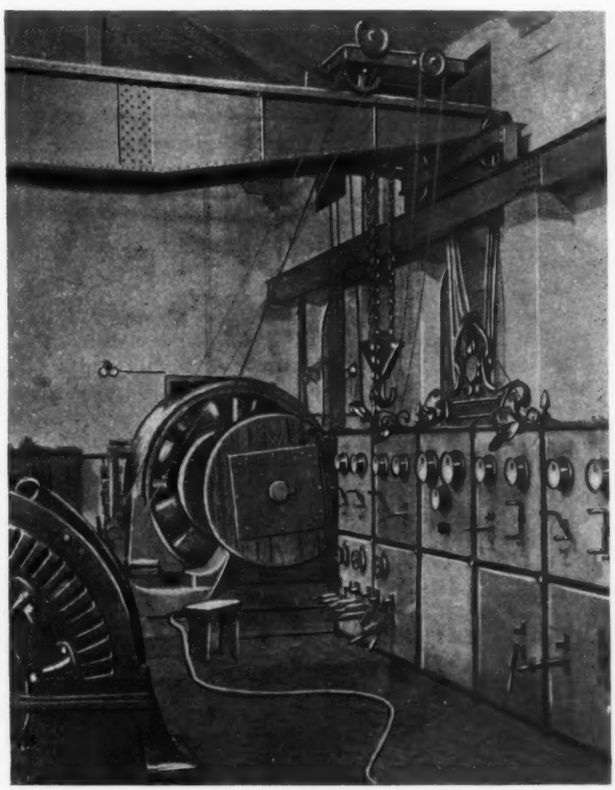


FIG. I.—REBANDING A SYNCHRONOUS MOTOR-GENERATOR SET.

copper of the low-voltage generator has sufficient rigidity to give an ample margin to the centrifugal pull, while the other has not. Banding engine-type armatures of large size is always troublesome as the engine can seldom be turned over by steam at the crawling speed required to feed a wire under 300 lbs. or 400 lbs. tension, nice and evenly in place; but in most plants having heavy parts to lift, an electrically operated crane is also available to help out an operation of banding should it be impossible to rotate the armature as slowly as desired by the engine, the crane taking a series of intermittent lifts on the flywheel till all the wire is on.

Motor generators of large capacity present possibly the worst phase of this particular kind of repair, as their rotating elements are usually made up of three or four parts, all on one shaft, utilizing every available inch inside and outside of the journals, possessing great weight and, consequently, large inertia, and some outside means has to be used to rotate the armature at a very slow speed. Conditions often do not permit of disassembling a large outfit further than removing one-half of the field frame, as they are frequently placed in already existing steam plants or where the amount of space around them is small, and the floor is none too strong to support the heavy parts deposited upon it. Where there is plenty of room on one side of the armature it is quite possible to drive the armature by a belt around the periphery of the armature, by making use of a fairly good-sized motor and employing a reduction gear in the drive; but in that case it is necessary to remove both halves of the field frame, which makes a particularly hard job when it is a horizontally split frame, as the end bearing has to be removed after jacking up the armature, then the lower half slid out and the bearing put in place again. Vertically split frames permit of this method of drive much more readily as only one side need be removed entirely.

As a rule, the shaft extension is only sufficient to accommodate the starting motor, or exciter, or both, as the design has required, and when either of these is absent the majority of outfits have no extension of the shaft on the opposite end unless an oscillator is provided, and then it does not follow that there will be sufficient area to secure a split pulley of ample size to start the rotating parts should they weigh several tons. To drive such a rotating element by means of a belt around the starting motor or exciting armature is obviously impossible on account of its extremely small radius.

The writer wishes to relate a particular instance illustrating some interesting features in line with the above remarks on large outfits. In a certain South American railway plant of German design and construction, an 850-kw synchronous motor-generator was installed in the best possible location with the ultimate purpose of supplanting the existing steam units, so that they would become reserve power. This outfit's revolving element consisted of three machines on one shaft, as it had an exciter on a smaller diameter of shaft extension at one end, and ran at the remarkable speed of 500 r. p. m. After about six months of almost continuous operation the direct-current armature developed a partial ground just back of the connections to the commutator necks through the edge of an insulated bushing provided to support the front chord of the winding, and immediately under the front band. A close inspection proved that several charred spots were developing large dimensions and immediate repairs were necessary. The cause was also apparent as due to an accumulation of dust and fine particles of carbon at this particular point swept in by the very strong air convection, due to the high speed, and also to the fact that compressed air was not available to clean this generator till after three months of operation.

These repairs seemed quite easy to make, since they were all on the front end of the armature, and the necessity of taking down the generator could be avoided, for this was a great feature of gain both in the time of interrupted service and the trouble of handling by a 20-ton hand crane the 5-ton upper half of this field. By skidding over as far as they would go from the commutator end, both the motor armature and generator field coils, the field coils cleared sufficiently, when the brush holder was removed to give plenty of room to remove the front band, unsolder the commutator necks, bend them to one side, raise the front ends of the armature winding sufficiently to remove the old insulation and replace with a new bushing. The accompanying photographs show the method used to replace the band, also the particular inaccessible location of the outfit, within 3½ ft. of the wall on one side and only 5 ft. removed from an engine and generator on the opposite side. The only location of the driving power left was from above; and when one contemplates the problem of driving at a slow positive speed a revolving element weighing 13½ tons, it means failure if the means are not at hand to get a large purchase. In view of the above objections to taking off the entire field frame, it was certainly gratifying to find on the commutator end of this outfit an extension of the shaft 10 ins. long and a key-way, which had evidently served the purpose of making the factory tests, but was partially hidden when the oscillator was in position.

In looking about for a means to furnish the power to rotate this large mass at a slow positive speed, the gear ratio of 25 to 1 on the hand-drive to the carriage of the overhead crane suggested interesting possibilities. It was apparent that if the carriage were jacked up, then the hand chain would transmit power to the one axle it was geared to, and a rope-drive seemed quite a feasible plan considering the clearance space around this axle. Accordingly a "nigger head" was made of two pieces of hard wood bolted together and turned up true with two grooves, and a hole through the center so as to clamp

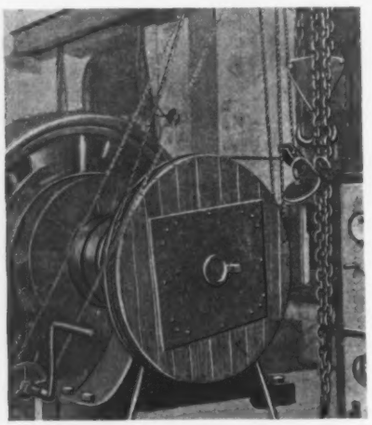


FIG. 2.—DETAILS OF BANDING ARRANGEMENT.

securely around the carriage axle. At each end a plate was securely fastened which engaged in the space between adjacent radial ribs in the wheels on each end of the axle, and prevented any possibility of the "nigger head" slipping. A large wooden sheave was easily improvised from the ends of old cable reels, and two pieces of old boiler plate, cut and filed carefully for a fit around the shaft and key-way, were bolted on securely as the photographs show. This sheave was 62 ins. in diameter and the resulting transmission ratio was approximately 1 to 200 from the hand-drive to the large sheave. A standard 1½-in. rope was passed three times about its circumference and four times in each notch of the "nigger head," and any desired tension was secured on the rope by the snatch block shown, which was fastened to a beam across the outside of the window.

Driving direct by hand to the chain on the upper sprocket would not have given a steady motion. An old chain sprocket was available, and by suitably mounting this on a double crank two men easily turned this armature uniformly, at an average rate of one revolution in 12 minutes. Although these preliminaries cost but little money, it required nearly three days to get them all ready, and the banding part of this repair job only occupied 12 hours after all was ready. These difficulties were foreseen, however, and while the insulating repair was going on these preparations were progressing. This particular band was of .091 in. steel wire and passed 60 times around a circumference of 15 ft. 7 ins., and required a tension of about 500 lbs., but was put in place neatly and very efficiently by this means.

Rio de Janeiro, Brazil. A. T. Ruttencutter.

APPLICATIONS OF RECORDING PRESSURE GAUGES.

The recording gauge can be applied with good results in many places where its use is at present unknown. The heating system, if equipped occasionally with a recording gauge might tell some interesting facts concerning back pressure. When the exhaust heating system is so arranged that live steam can be turned in to supplement the exhaust when necessary, then the recording gauge might, perhaps, give away some interesting and decidedly expensive using of live steam in a manner hitherto undreamed of by the owner.

A recording gauge connected to the steam chest of a duplex boiler feed-pump would show when, and under what pressures, steam is admitted to the pump in question, and it would prove rather interesting for the owner to know that this piece of apparatus was kept under pressure nineteen-twentieths of the time that the engines are running. Some very interesting calculations of the amount of steam needlessly forced through the pump, could be made for the entertainment of the engineer.

Did you ever connect a recording gauge with the water end of your boiler-feed pump? Probably not, but the writer has, on several occasions, found the record thus obtained to yield very interesting traces of badly working check valves, over-weighted pump springs, and similar things which cost considerable coal to maintain. When it is necessary to maintain 200 lbs. pressure in the pump in order to force water against 125 lbs. steam pressure, then it is time to overhaul something. If one would invest in a recording pressure gauge he would be surprised to find how little time it takes to detect and cut off leaks aggregating more each month than the sum invested in the gauge.

New York City. James Francis.

TOOLS FOR SCRAPING BABBITTED BEARINGS.

When a new machine is installed, or when the bearings of an old one must be rebabbitted, the engineer must be alert with tools for scraping the new bearing surface to a good fit. There is not as much of this work necessary now, as there used to be, for machine manufacturers have recognized the necessity for scraped bearing surfaces and do most of that work in the shop. Still a bearing occasionally comes along which needs the scraper and as all newly babbitted bearings must be scraped, the engineer needs a good scraping kit, as above stated. The usual method is to grind up three or four half round files into something near the desired shape and call the things thus made "scrapers."

For a small sum, a much better set of tools specially made for scraping bearings, can be procured all ready for business. These tools come in a neat box resembling a tap and die box and can be procured either hollow ground or ground in the ordinary manner. A set of 5 cold chisels and a set of packing tools can be procured also if desired. Besides doing sundry repairs about the machinery with these tools, bearings may be quickly scraped to fit the journals.

There is, however, a method of making scrapers in the factory, which will go a long way toward equalling any "store" set of scrapers the writer has ever seen. The ordinary form of scraper looks somewhat like a bent-up half-round file with all the teeth ground off as shown in Fig. 1. In fact, a very good scraper may be made in just that way, provided the file is hardened after it has been ground and bent to shape. If it is hollow ground, so much the better. The shape of the tool along its length is given by the sections, of which there are six shown in the engraving. By using the point of the tool, a small box

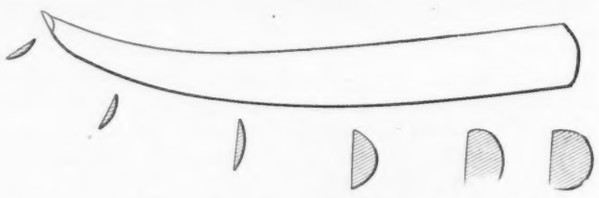


FIG. 1.—EXTERIOR AND SECTIONAL VIEWS OF SCRAPING TOOL.

may be readily worked out, while for larger bearings, that portion is used, several sections toward the handle, which best fits the diameter of the bearing to be scraped.

Fig. 2 shows a form of scraper with which, when properly made and sharpened, one man can remove as much metal in a given time as could three men with the excellent form of scraper shown in Fig. 1. The scraper shown by Fig. 2 is commonly made from a worn-out flat file, which is forged as shown by the engraving. It is not even necessary to grind off the teeth, when this form of scraper is to be made, and the grinding of all the teeth off of a big file, even when worn out, is not an

easy job. The file is bent up as shown, a half-inch or so of the side *a*, being hammered flat—it may be ground if desired, but hammering will answer as well. The cutting edge of the tool is ground up as shown at *b*.

The tool is not ground to an edge until after it has been hardened. The grinding should be done with a very small emery wheel, so as to leave a concave surface at *b*. It is the grinding of this tool, and the shaping of the bend, which determines whether the tool will be a good one or a very bad

FIG. 2.—END AND SIDE VIEW OF HOME-MADE SCRAPER.

one. If the scraper does not work well at first, the bevel of the grind should be changed, or the angle at which the tool is bent. There is one certain angle for each, at which the cutting is the best. Once those angles are found, the manner in which that scraper will cut will be a revelation.

The ordinary scraper takes a very little cut crosswise of the bearing, while with the new tool, a broad cut can be taken the entire length of the box. The depth of the chip it is possible to remove, depends to a limited extent upon the pressure put upon the tool, and directly as to the manner in which the tool is ground and bent. Much metal may be taken off very quickly with one of these tools and likewise, a very thin, small scraping may be removed when the work is nearly finished and only light chips are desired. A scraping tool which permits the thickness of cut to be varied instantly and at will, from 1/32 in. to 0.001 in., is certainly a very desirable one to possess, and the one shown by Fig. 2, will, if properly made and ground, do all that the writer claims for it.

WILLOUGHBY, OHIO. JAMES F. HOBART.

WATER COOLED RHEOSTAT.

A few years ago I had to install a big hoist, driven by a direct-current, series-wound motor of 150 horse-power from a 100-volt line. There was great need of this hoist, and immediately after installment it had to carry a heavy load. To our great disappointment, a costly and very complicated rheostat with automatically operated controller broke down, and as no satisfactory repair could be done in a short time, I immediately shipped the rheostat back to the factory for repair, and

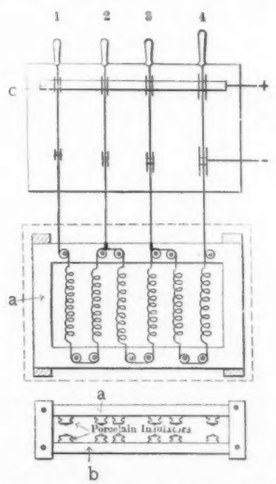


FIG. 1.—WATER-COOLED RHEOSTAT.

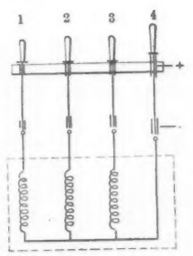


FIG. 2.—RESISTANCE GROUPS IN MULTIPLE.

meanwhile decided to try a water-cooled, temporary resistance (as I had some experience with that type in other cases). A wooden frame was immediately constructed (Fig. 1), consisting of two parts, *A* and *B*. Porcelain insulators were used to support the resistance wire, wound in spirals, six on each side, making a total of twelve spirals. The total resistance was divided in three groups, four spirals in series in each. The first group contained 30 ft. of No. 8 galvanized iron wire; the second group, 30 ft. double No. 8 wire, and the third group, 40 ft. triple (three in multiple) No. 8 iron wire. By means of four leads these resistances were connected to four switches, mounted on a distant board. The assembled frame with resistance was 12 ins. high, 18 ins. long and 7 ins. wide and was immersed in a water tank (shown by dotted lines in Fig. 1), with inside dimensions of 12 ins. x 22 ins. x 16 ins., with ¾-in. diagram, in and out-going pipe for circulating water.

The top jaws of the switches were connected by means of strap *C* to the line, the motor lead being connected to the bottom jaw of switch 4 (the switch connecting the other motor terminal with the line is not shown on the drawing).

By closing switch 1, switches 2, 3 and 4 being open, the motor has approximately 200 amperes starting current, all resistances being in series. By closing switch 2 the resistance is decreased by short-circuiting the first group, and by closing the other switches, the resistance is further decreased, until the last switch short circuits them all. This rheostat operated satisfactorily as a starting and regulating resistance, although afterwards a fourth group was added to obtain wider regulation.

Fig. 2 represents a modification, where resistance is changed by connecting individual groups in multiple, as it is easy to see

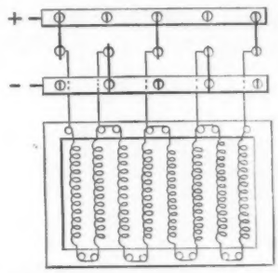


FIG. 3.—ARRANGEMENT FOR VARIOUS COMBINATIONS OF SERIES OR PARALLEL CONTROL.

from the engraving. The widest range of regulation is obtained with connections, as shown on Fig. 3. Here double-throw switches are used, so that all combinations of groups are possible, from all in series to all in parallel. For fine adjustments an ordinary small rheostat may be connected in multiple with the above rheostat.

I have found 15,000 to 18,000 amperes per square inch a fair current density in such rheostats, provided they are immersed in tank with water circulating at a moderate rate. German silver wire admits such a density only for starting resistance; for regulating purposes it is safer to use 12,000 amperes per square inch.

The described rheostats represent a very cheap and convenient form of resistance for testing big generators after they have been installed. The other forms of temporary resistances, such as the ordinary water rheostat or rheostat consisting of iron pipes with water circulating through them, are very bulky, more expensive and less reliable, in addition to possessing some other inconveniences, such as fluctuation of resistance, danger from gases, electrolytic effect, etc.

EAST PITTSBURG, PA. JOHN P. NICKONOW.

PECULIAR BEHAVIOR OF REDUCING VALVE, AND ITS CAUSE.

It seems a very peculiar piece of engineering which requires a reducing valve between boiler and engine, but in some instances it may be good practice, especially when trying to make the best of existing conditions. A steam boiler will not carry as much pressure safely, at the end of ten years, as when it is just out of the shop. There is a certain length of service for any steam boiler, depending upon the manner in which that boiler is used and taken care of. The writer, when at one time engaged in inspecting boilers for an insurance company, came across a boiler which had been in constant service, and was then in use, for 30 years, with no signs of depreciation.

The boiler in question probably had the easiest work and the best care of any boiler in the world. The water was pure, and the boiler was fired by the waste gases from a blast furnace which was always in blast for months at a time, consequently the boiler never varied in temperature to any extent. It kept just about so hot, week in and week out, an ideal condition for the boiler, and it may be in use yet.

The majority of boilers may be expected to deteriorate at least 5 per cent to 10 per cent each year. This being the case, the boiler must be constructed to carry a much heavier pressure than can be used at first, or that can be carried by the average simple, non-condensing engine.

A Corliss engine of a well-known type will not stand a pressure greater than 125 lbs. and the boiler must stand wear for 10 years and then be able to carry 125 lbs. This means a boiler built for nearly 175 lbs. pressure. It worried the engineer of the plant not to be able to carry 175 lbs. pressure upon the boiler. He claimed that it was economical to generate steam under the higher pressure, even when it could not be used in the engine.

To this end, the steam pipe was cut in two and a pressure reducing valve placed in position. The valve was adjusted to take steam at any pressure above 120 lbs., and to deliver steam at 120 lbs. The valve was adjusted to do that, but whether or not it actually did, was a conundrum which kept the engineer guessing.

A steam gauge was placed in communication with the interior of the steam pipe between the reducing valve and the engine, and it seemed to the observer that the pressure ran sometimes too high, at other times too low; that instead of holding the steam at an even pressure in the engine pipe, the reducing valve allowed the pressure to fluctuate quite a little. It was finally decided to connect a recording gauge with the steam pipe and see what kind of record that instrument would make. This was done and the very first paper taken out of the instrument was a revelation to all who studied it.

While the engine was shut down, the recording gauge registered very closely to 120 lbs., at which the reducing valve was supposed to be adjusted. But as soon as the engine was started, and the pressure reduced in the steam pipe, something happened. The pressure slowly fell until it reached 95 lbs., then it as slowly rose again until 125 lbs. was indicated upon the revolving chart. This fall and rise of pressure was not sudden or abrupt. Instead, it was slow and gradual, and after the rise to the maximum pressure stated, it slowly fell until low-water mark was reached again. One of the by-standers expressed himself very much to the point when he said: "It looks like a tide-chart. There's a regular ebb and flow."

One look was all that was necessary, when the chart from the recording gauge was passed around. The reducing valve was overhauled, and it was found that the stem had become bent a very little, also that some of the parts had worn, making close regulation impossible. The proper repairs being made, the valve was replaced and the steam pressure was found to stay at 120 very closely, proving that the trouble was caused by the sticking of several parts of the reducing valve.

Scranton, Pa. John Scott.

PRACTICAL SPLICING AND TESTING OF LEAD-COVERED TELEPHONE CABLES.

Cables are usually left by the pulling-in crew without any reference to their final arrangement, and it should be the jointer's first duty to inspect the cable thoroughly from the edge of the duct to the sealed end in order to ascertain whether any injury has been done the cable while it was being pulled in

Where there are several cables to be jointed in the same manhole care should be exercised that the corresponding incoming and outgoing sections are spliced. After the protectors have been placed in the mouths of the ducts the cables should be neatly bound and stored around the sides of the manhole and the ends brought in position for splicing. Heat should be applied to the outside of the cable to aid in bending it since this suffices to heat the insulation as well as the lead sheath, so that when the cable is bent the insulation will not break or crack. When bringing the ends into position for splicing care must be exercised that the ends are brought into such position that when the joint is finished the splice will come between the hangers, or whatever supports the cable, so that no strain will be on the joint. If the ends of the cables have been permitted to lie for any length of time in manholes subjected to moisture, any slight imperfection in the soldering will result in more or less moisture finding its way to the insulation. A moisture test should, therefore, be applied before the ends are spliced. This may be made as follows:

The end of the cable should be dipped in a pan of hot paraffin when, if moisture is present, bubbles will appear. The end of the cable should next be cut off with a hack saw and again dipped in hot paraffin when, if moisture be present, bubbles will again appear. If moisture still is evident and it is impossible to cut away any more of the cable, heat should be applied to the outside of the cable.

If there is any suspicion of gas in the manhole a pan should be placed under the cable and hot paraffin poured on the cable, starting at the duct and working down very slowly toward the end. By this means the moisture will be driven out at the open end, the pan catching the drippings. If there is no gas in the manhole a "blow-pot" may be used, care being taken not to burn holes in the lead sheathing. If the cable is covered with saturated fiber and a blow-pot is used, a steel screen must be placed between the latter and the cable, so that the covering will not be ignited. Where there is any doubt as to the freedom from moisture a careful insulation test had better be made before the joint is made up. Both ends of the cable should never be cut before making sure that no moisture is present in the other end, and it not infrequently happens that a splice must be moved because of moisture.

FIGS. 1, 2, 3 AND 4.—VARIOUS STEPS IN MAKING A SPLICE IN CABLE WIRES.

Trouble is frequently experienced owing to the presence of gas in the manhole, and precaution should always be exercised that all gas has been removed before lowering a pan of hot paraffin or a blow-pot into the manhole. This is best done by using an inverted umbrella made especially for this purpose. This is lowered into the manhole in a closed condition, then opened and suddenly withdrawn. The opening of the umbrella and sudden withdrawal forces out the gas. Another method which is widely used consists of placing a cloth screen above the manhole and on the side opposite to the direction from which the wind is blowing. The wind, on striking the screen, is deflected downward, causing an eddy which forces the gas to raise from the manhole.

In preparing the cable ends a circular score should be made in the lead sheathing two feet from the end of the cable and two lengthwise cuts separated about ¾ in. run from the circular score to the end of the cable, care being exercised not to cut into the cable insulation. With some sharp-pointed tool such as a screw-driver the narrow strip of lead sheathing should be pryed up until a pair of pliers can be used; then, with the latter instrument, the strip should be lifted up until it reaches the circular score. It should then be bent backward on the cable and given a gentle tap with a hammer at the bend. It may then be bent back to its former position, when it will usually break off.

The wire should now be cleared of the rest of the sheath in a similar manner and twine or wicking wound around the cable at the point where the wires emerge from the sheathing. This winding should extend close to the lead sheathing in order to prevent the paraffin from following along the core of the cable. The paraffin should be heated to about 212 degs. F., and it is an easy matter to determine whether or not the paraffin has the proper temperature by inserting a piece of newspaper in the paraffin when boiling. When the proper temperature has been reached the paper will char. Some hot paraffin should be poured on the cable when the lead is removed in order to stop the paper insulation from unwinding and also to prevent moisture from getting into the cable.

In making the splice the end of the cable should be opened by bending back the conductors layer by layer until the center pair is reached. The center pair from one cable should be brought together with the center pair of the other cable, as shown in Fig. 1, and a paper sleeve slipped over one wire. The ends of both wires should then be brought down and twisted together, as shown in Fig. 2, and then bent back, as shown in Fig. 3, after which the paper sleeve may be drawn over the

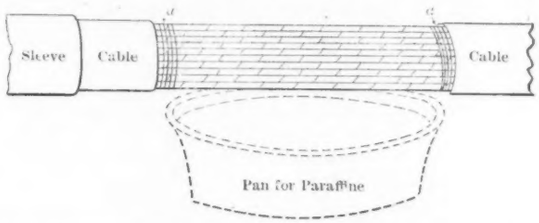


FIG. 5.—CABLE BEFORE WRAPPING IS APPLIED OVER THE JOINTS.

joint, as shown in Fig. 4. When the joints are made in this manner there is no danger of the paper sleeve working away from the splice, as one sleeve holds the other sleeve in place. All of the other conductors should be treated in a similar manner, like colored insulated wire being joined to like colored insulated wire and the joints being broken as much as possible so that when all the splices are made the combined joint will be as small as possible.

After all the joints have been made they should be bunched together and boiled with hot paraffin. A layer of strip muslin one inch wide should then be bound around the joints as tightly as possible and saturated with hot paraffin so as to eliminate moisture. Two other layers similarly treated should be placed over this layer of muslin. Fig. 5 shows how the cable will look after all the joints have been made and before the wrapping has been put on. The wrapping of twine or wicking is shown at *a*. The pan shown under the joint is placed there for the purpose of catching the drippings of paraffin in the boiling-out process.

The lead sleeve which should be slipped over the cable before the latter is opened up for splicing is prepared as follows: The sleeves vary in length for straight joints from 28 to 30 ins. and in diameter from 2 to 3 ins., the thickness likewise varying from 3/32 in. to ⅛ in., depending on the size of the cable. Both ends of the sleeve should be scraped inside and out for a distance of about two inches and the surface so

FIG. 6.—LEAD SLEEVE IN PLACE ON CONNECTED CABLES.

cleaned smeared with mutton tallow. The latter material is put on to protect the cleansed surface from tarnishing by contact with air or by contact with the hands of the operator, and also to aid in making the wiped joint. The sleeve thus prepared should be slipped into position over the finished joint so that an equal amount of sleeve will overlap the cable sheathing at both ends. The sleeve may then be beaten down to fit the sheathing by a dressing tool; the place on the sheathing where the joint will come being first brightened and then smeared with tallow. A plumber's joint should then be wiped on each end, as shown by Fig. 6, by a man experienced in making such joints. If properly made bright spots will appear in the joint after it has cooled off.

All the cable sheathing entering the manhole should be bonded together by means of a copper wire to insure that all the cable sheaths are at an equal potential, and also that whatever bonds are run for the protection of one sheath will afford

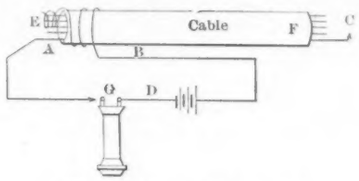


FIG. 7.—INSULATION TEST.

protection for all. The lead should be scraped where the bond is to be made and a No. 10 or larger copper wire wound around each sheath and securely soldered to all.

Fig. 7 shows an insulation test diagram. *A* and *C* are the ends of the cable wire under test; *B* and *D* are wires connected to the battery. In arranging the cable ends for the test the insulation is removed from all the wires and the wire *B* is bound around the lead sheathing and also around the wires shown at *E*. The wires are carefully separated from each other and from the sheathing. After the connections have been made as shown, rapid taps are made with the wire *A* on the binding post *G* of the telephone receiver. The first tap will produce in the receiver a distinct click; if the cable is very long a second faint click may possibly be detected. If the wire under test is well insulated no further sound will be heard in the receiver, but if the wire under test is crossed with any other wire in the cable, or with the sheathing, each tap will be followed by a clear click. If there is moisture in the cable causing a partial connection, clicking sounds will be heard the loudness of which will depend upon the amount of moisture present. All of the wires in the cable should be tested and if any trouble is found it is best to carefully inspect the exposed ends to make certain that they are clear of each other and from the sheathing.

In testing for broken wires the connections are made, as shown in Fig. 8. All of the insulation is removed from the

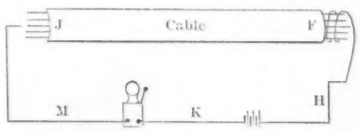


FIG. 8.—CONTINUITY TEST.

F end of the cable wires and a wire wrapped around the ends as shown, the other end of the wire being connected to one side of the battery. The wire *K* runs from the opposite side of the battery to a signal bell and the wire from the other terminal of the bell runs to the *J* end of the cable, where the wires are carefully separated from each other and from the sheathing. In testing, each wire is touched in turn, and if the bell does not ring it indicates that the wire which is being touched is broken.

For aerial work the cables are spliced in the same manner as for underground work only that a stage or platform must be erected at the splice, and a blanket spread over the joint to keep out wind and moisture. In splicing subaqueous cables the armor wires should be bent back on the cable and tied in this position until the joint is completed. After placing a wrapper of jute over and around the joint, the wires may be placed in such manner that they will interlace with those of the other end. They may then be bound down closely by means of steel wire wound closely around the joint for the entire length of the splice. The joint is then washed with soldering acid and the wrappings soldered together carefully, preferably with the aid of a wiping cloth.

DULUTH, MINN. O. F. DUBRUIEL.

QUESTIONS AND ANSWERS.

Can you give me the composition of an alloy that will melt at about 110 degrees Fahr.? S. R. S.

D'Arcets' alloy with mercury is said to melt at a temperature of 113 degs. F. Its composition (parts by weight) is as follows: Bismuth, 50 parts; lead, 25 parts; tin, 25 parts, and mercury, 250 parts.

The commutator of a motor has two small holes in the mica segments, which give considerable trouble. We have tried resin, sulphur, cement and shellac without success. Can you suggest some other substance? W. J. L.

Use a mixture of powdered mica and shellac or some insulating varnish. This should only be used as a temporary expedient until new mica sheets can be substituted.

A generator running at 250 r.p.m. will generate 110 volts. What must be the r.p.m. if a potential of 140 volts is desired, the conditions remaining unchanged? J. C.

If the machine is separately excited with a constant field, the r. p. m. must be $(250 \times 140) \div 110 = 318$. If the machine is self-excited (direct-current) the field strength will be somewhat increased at 140 volts, so that the speed will be somewhat less than 318.

Can alternating-current motors designed for 60-cycle circuits be operated on 50-cycle circuits? J. N. R.

Yes. The speed will be reduced somewhat, but the permissible output would be practically the same. The iron losses would be greater, so that the efficiency would probably be lessened. See article on "Abnormal Operating Conditions of Electrical Apparatus," by A. E. Buchenberg in the October, 1906, issue.

We have a belt-driven alternator which we wish to run in exact synchronism with another; but we have been unable to get just the proper speed, the speed of one machine being a trifle too small. Can you suggest a method by which we can bring this machine up to the proper speed? G. W.

Glue thin canvas or strong manila paper onto the driving wheel to which the slower alternator is belted until the exact speed is obtained. The glue should be applied thin and quite hot, and the material should be pressed firmly down upon the pulley. By this means, the diameter of the pulley may be increased to that necessary to give the proper speed.

Is it possible to obtain both alternating and direct current from a bipolar direct-current generator? If so, how can it be done, and what will be the frequency of the alternating current? A. C. E.

A bipolar direct-current generator may be caused to deliver alternating current by connecting a pair of insulated metal collector rings permanently to two commutator bars diametrically opposite each other, and by keeping these rings in continuous connection with an outside circuit by means of a pair of brushes separate and distinct from the direct-current brushes. The frequency of the alternating current in cycles per second will be equal to the revolutions per second of the armature.

How can the presence of water be detected in transformer oil, and if present, how can it be easily removed? W. T. S.

If water be present, it will be found at the bottom of the tank owing to its higher specific gravity. Therefore, pour a quantity of oil, taken from the bottom of the tank, in a bottle and after heating some crystals of copper sulphate until they disintegrate into a white powder, pour the powder into the bottle containing the sample of oil. If the copper sulphate powder resumes its original blue color, or takes on a bluish tinge, water is present. There are many ways of getting rid of this water. The simplest method that we know of was described by R. B. Treat in the March number.

Kindly inform me what modern methods are used for ventilating motor and generator armatures. E. S. A., Jr.

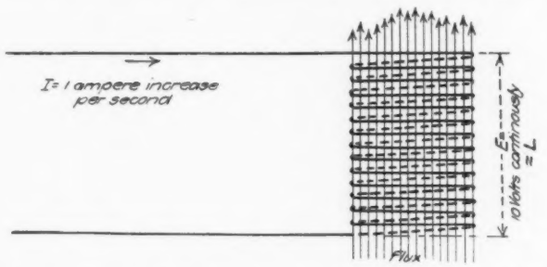
The armatures may be designed with large radiating surfaces so that the heat is rapidly dissipated. Ample duct space may be provided, and this may be supplemented by fan-blade projections which force a current of air through the ducts and armature wires when the dynamo is in operation. The tendency now is to equip the rotating member with large outwardly extending blades and to provide numerous ducts within the rotating and stationary cores so that motors of a given size can carry continuously larger loads than heretofore; the load on machines being largely limited by the facilities for cooling provided. Sometimes motors and generators are placed over openings in air-blast chambers used for cooling transformers or over openings which naturally cause a draft of air to pass through the machine from below.

In a local central station a rotary converter has some sort of a device attached to the bearings, by means of which a lamp is lighted, it would seem about every revolution. What is the device, and what is its object? H. B.

The device is doubtless a magnetic oscillator. A magnet is mounted upon one of the bearing housings in such manner as to attract the end of the shaft. When the circuit is closed, the magnet draws the shaft towards it, and when the circuit opens the armature tends to resume its normal position, which is usually determined by the leveling of the converter. The magnet has in series with it a make and break device called an interrupter, which is controlled by a dashpot to secure the proper frequency of action. The lamp may be used as a signal to indicate from a distance that the device is in working order, or it may be used as a resistance. The object of such a device is to produce periodic motion parallel to the shaft so as to offset the tendency of the armature to run in one position and thus to cause the brushes to wear the commutator and collector in grooves, and not give that smooth, even surface which is conducive to sparkless operation. The bearings also do not work under the most favorable conditions where the shaft has no lengthwise motion.

Can you give a physical explanation of the quantity L, the coefficient of self-induction? One frequently sees the statement "energy is stored in an induction coil." Please explain just what is meant by this statement. J. S.

The coefficient of self-induction of a coil which is designated by the letter L, is expressed in henrys. It is equal numerically to the counter e. m. f. in volts produced in the coil by the changing flux, when the current changes at the rate of 1 ampere per second. If in the accompanying illustration the current changes at the rate of 1 ampere per second, and the



flux varies at such a rate that the counter e. m. f. is 10 volts, then the coefficient of self-induction, L, is 10 henrys. In order to find the value of the stored energy, consider the conditions at the end of 100 seconds. The current will be 100 amperes and the e. m. f. will be 10 volts. The final power will be $10 \times 100 = 1000$ watts. The power initially was 0 watts and it increased uniformly throughout the 100 seconds; hence the average power was 500 watts. The total energy is equal to the product of the average power and the total time. Therefore, the stored energy is $500 \times 100 = 50{,}000$ watt-seconds. Assuming a general case, and letting the current change at the rate of a amperes per second, then the time to reach a value of I amperes will be $(1 \div a)$ seconds. The continuous e. m. f. will be La volts. The final value of power will be ILa watts; the average power having been $(ILa) \div 2$ watts. The total energy for the time $(I \div a)$ seconds will be $(ILa \div 2)$ $(I \div a) = LI^2 \div 2$ watt-seconds. This energy is stored in the magnetic field and not in the coil. The latter serves merely as a means for transferring the energy from the supply system to the magnetic field. The same value of magnetic field represents the same amount of stored energy independent of the coil which may have been used in producing the field or of the time consumed in building up the flux.

CENTRAL STATION SALE OF CURRENT.

A Central Operating Organization.

By Carmelita Beckwith.

The advantages of a central production and marketing management for scattered properties, manufacturing the same or similar commodities, are now thoroughly established. That electricity and gas are to be dealt with much as if they were popular commodities perfectly tangible and material in nature has also been understood fairly well for some time. Still the coupling together of these principles and conditions to make the basis of a widespread and successful business is a development of recent years and one not even now generally understood except to the direct participants. The centralized operating organization handling many entirely independent electric and gas properties in separate territories is well exemplified by the operating department of J. G. White & Company.

As the question of consolidation does not enter, the advantages to associates are those eminently fair ones derived from what is in reality a clearing house for the multifarious experiences of many large production and selling companies dealing with a comparatively new product; a clearing house of experience managed by the best talent in the country for the operation of public service properties. The fact that the business in which all are engaged is developing so rapidly and yet is further from complete standardization than any other extensive business makes the form of association particularly valuable. Each company not only learns the experience of all the others, but receives its lessons formulated to meet its own particular needs by mentors of wide reputation.

In every feature of the business the influence is exercised. The engineering operation of the plant proper is but one aspect. Besides there are the auditing and accounting, the statistical, the purchasing, the legal and the business getting aspects, all under the direct influence of the central organization. Probably the business getting end demands, more than any other, the existence of a central operating management. It is very nearly the most important and is certainly at the same time the least systematized and least understood in general of all the departments of the electric power, lighting and railway and gas business.

The production of electricity or gas under any given set of conditions does not vary widely. Ways and means for securing and holding customers are extremely varied, and yet there is always one best way to meet any given situation. That way can generally be discerned at any early stage by the highest business getting talent, but less talent may expend endless time and money discovering it. The central organization can afford to engage this best talent, and through the central organization its high grade service is made available to companies who could not otherwise afford it.

The leading operating organizations of the country are distinguished not only for excellence of personnel, but for their organic simplicity. The head of the operating department of J. G. White & Company is a vice-president of the firm. Next in rank is the operating manager, and under him are the railway manager, gas manager, the electric lighting engineer, operating auditor, operating counsel and publicity manager.

The vice-president in charge attends principally to the financial affairs of operated companies and of the central organization; but all operating policies regularly in vogue or drawn up to meet special problems are subject to his approval. The operating manager supervises all details of operation and plans for the improvement thereof. He is practically the head of the operating administration proper. To each of the three technical specialists all questions in their respective fields are referred for investigation and report. The gas manager is a leading

HOW TO IRON WITHOUT A FIRE

The Electric "Light" in your house can easily be used to heat the latest electric flatiron:

All you have to do is to turn the switch, once the cord attached to the iron is in place.

Then the iron quickly heats up, and stays hot as long as you want it to. You don't have to change irons or "put up" with a hot stove in the room—nor do you have to wear a path in the floor travelling between the stove and the ironing board.

Ironing day will never be a pleasure; but the drudgery of it has been done away with where the new electric flatiron is being used in thousands of homes throughout the country.

The latest electric flatiron, now to be had, is lower in cost than ever before to our customers, who will be supplied this month at the wholesale price to aid their introduction in Wilkes-Barre.

No orders received except from our regular customers.

These irons retail at $3.90 each. But one will be delivered to any home in Wilkes-Barre on 30 day's free trial.

If you do not like it after trying it for one month, send it back at our expense and do not consider yourself under any obligations.

We shall at least find pleasure in the thought that we have saved you four days of extreme discomfort during August.

Wilkes-Barre Gas and Electric Co.

27 North Main Street. New Phone, 1052 Old Phone 629 R

WHAT'S IN A PIE?

Oh various things. But every pie, whether it's pumpkin, mince, apple, cocoanut, lemon or any other kind, cooks best, looks best and tastes best when baked in the oven of a

Gas Range

A concentrated heat is an economical heat. In a Gas Range Oven, an entire dinner may be prepared at one time. This is a great advantage in hot weather, for it does away with all superfluous heat that makes the house so uncomfortable on hot days. Order your range now. There is no time like the present.

The Citizens Gas Light Co.

United Phone. Elks' Building

ADVERTISEMENTS USED AT WILKES-BARRE, PA.

authority in the construction and operation of gas plants and practically manages all the gas plants operated by the company. The railway manager administers the policies for electric railway operation on the various properties, and the electric lighting engineer looks after matters of electric lighting and power and high tension transmission. At the command of these three technical heads, for the details of matters of engineering construction or reconstruction, there are the extensive facilities of the construction and engineering departments maintained by the company.

A sub-department very essential to the effective carrying out of the operating routine is the statistical division. At the end of each month there is prepared a complete comparative statement of the vital operating figures and ratios on all the properties, and this statement is sent to the resident managers. In addition there is sent to each manager at the same time a special letter from the operating heads pointing out in what respect his particular administration is defective as compared with others and the reasons for inefficiency. These letters are in the form of recommendations, not orders. The aim is to maintain the ultimate responsibility of the resident managers for the successful operation of their properties and to aid them with constructive criticism and a general consulting service. Normally they are free to take what advantage of it their own judgment dictates, and only when there is a really unwise divergence from the approved operating practice of the day does the central office interfere absolutely. It is hardly necessary to point out how this system tends constantly toward the elimination of faulty practices and the establishment of a uniform régime made up of the best methods evolved by experience on all the properties operated.

This same theory works out effectively in handling the accounting and business getting as well as in the management of the strictly engineering features. The operating auditor prepares all operating statements for owners of the respective properties, but his most reliable work, in which he is aided by traveling auditors, lies in systematizing methods of accounting and bookkeeping so that all unnecessary duplication and repetition or other waste of time or money are done away with. The variety of conditions experienced by the accounting head in handling a great many scattered properties enables him to evolve short cuts in routine applicable in general to all properties that could not be developed in the operation of one property.

The department of business getting, because of the infinite possibilities of its work and the fact that many new ones are being discovered constantly, is to-day probably the field of the most interesting developments in this great task of managing grouped public service properties. The publicity manager supervises divisions of business getting which are separately organized, one in the resident management of each property. They all work under directions from headquarters, and these directions are based upon the publicity manager's general experience, his experience afforded in all the properties immediately in hand and the consulting service of an eminent advertising authority.

The problems to be met in the business getting end are the most varied in the whole propaganda and call for the incessant attention of the best business getting brains at headquarters directing the men on the ground and supplying them, not only with working ideas, but where necessary with full plans of business getting campaigns and the printed matter for carrying them out. It is safe to say that nearly every local physical influence in each plant that shapes the internal economy of operation is felt also in the external economy or business getting, but more potent still in the business getting prospect is what may be termed the human element. Communities in the composite vary infinitely more than the physical conditions that govern the operation of plant. In each territory the business getting campaigns conducted through the mails are individualized to meet not only peculiarities of physical environment, but the peculiarities of the residents themselves as determined by careful preliminary study. Then there are the peculiarities of individual consumers or "prospects" that can be dealt with only by personal representation and correspondence on the part of skillful salesmen.

Plainly the business getting directorship at the head office, with intimate knowledge of the experience encountered in operation all over the country and under all sorts of conditions, has as good an equipment as can possibly be achieved for devising new plans to meet new conditions and improving old plans to deal with conditions already analyzed. The assistance of an outside consulting authority, however, is found almost invaluable. From this source comes much of the copy used and all the special printed matter incorporating the latest ideas for interesting and holding the people. Some of the most telling advertisements recently issued by J. G. White & Company in building up the business of a property is reproduced with this article.

Altogether the operation of central stations in groups is a proven success and interesting testimony to that effect is available not only in the operating field, but in the banking business. Large banking houses are coming to depend on these central operating organizations more and more for the management of properties of which they hold the securities and upon the earning powers of which their income depends.

Recently a leading American banking house issued to its district managers and salesmen a folder of instruction for marketing the securities of a certain large property, the organization of which under a central operating management has attracted much attention in financial circles during the present year. From this folder the final paragraph is quoted as follows:

"As an example of what may be accomplished in this direction, a case may be cited of an electric lighting and power property, the management of which was recently assumed by the operating department of J. G. White & Company. This property had been running behind for several years. Within a few months it was earning a substantial surplus, the ratio of operating expenses to gross earnings was reduced about 30 per cent and the gross earnings showed an increase over corresponding months of the previous year of nearly 40 per cent."

New-Business Campaign in Towns of From 3000 to 20,000 People.

Mr. R. W. Hemphill, Jr., of Ann Arbor, gave an interesting talk on this subject at the Michigan Electric Association convention, Aug. 22, outlining the methods used by his company, the Washtenaw Light & Power Company, which gives service in Ypsilanti, Ann Arbor and neighboring villages. One of the most important points is the character or standing of the manager or superintendent in the community in which he lives. Public utility corporations depend much on the confidence the public has in the man who is in charge of the business; his social standing, his business standing and the part he plays in his community. Every citizen owes a duty to his family or to those depending upon him, and also a large duty as a citizen. Public utility managers are not commonly elected to political office. At the same time in every community there are positions and different commissions in connection with the municipal government he is able to fill, and it should be the duty of every man in a position of this kind to play his part and do his work in connection with different enterprises.

The office of the corporation should be centrally located and the business should be conducted with very high efficiency; that is, the public should be able to transact business with the least discomfort and inconvenience. The office should have display windows and exhibition rooms. The displays should be changed once a month or so, to keep up interest in them. The company with which Mr. Hemphill is connected displays fans one month, lamps and glassware another, heaters another, thus making a distinct exhibition in each line. In the exhibition rooms there are connected all articles that the company advertises. Motors and flatirons are connected up ready to run. In

cold weather, on payment days, coffee percolators are kept in operation, so the ladies who come to the office are served with a cup of coffee and various eatables. Such attention makes a pleasant impression. Last spring his company sent out two men in a house to house canvass. If electric service is being employed in the house the representative would say that he just called to see if everything was satisfactory. This attention creates a pleasant feeling between the customers and the company. If electric service is not used he puts in a word or two about some neighbor who has it and is satisfied with it. The representative makes a record on an index system having a card for each resident in the town, stating concisely what electric equipment is in the house and such remarks as the solicitor is able to secure. The representatives visited 3000 residences in six weeks. From the data thus gathered, cards were arranged by streets, and the company knows how many houses are using gas, kerosene and electricity. The number of kerosene lamps is surprising. In a city of 3100 houses with a very efficient gas company of 50 years' standing and an electric company doing business for 12 years, there are 850 homes using electric, 1400 gas and 300 using kerosene lamps.

The company enters into a yearly contract with each daily paper for advertising for an amount not more than that paid by the printing company for motor service and light. Mail advertising is used for gas, and some bulletins are also sent to the company's electric customers. A visit is made to each business man periodically by a solicitor, and as each month passes many gas arcs are superseded by electric lamps. The company during this spring, in a town of 8000 population, obtained an increase of from 40 to 48 per cent each month, compared with the corresponding month of the year before. In another town an increase of 38 per cent was obtained. In any town in Michigan at least 25 per cent increase can be made by a systematic business-getting campaign.

A Franchise Campaign at Grand Rapids, Mich.

By Lewis W. Bailey.

A unique campaign of education is being conducted in Grand Rapids, Mich., by the Grand Rapids-Muskegon Power Company, and it should prove most effective.

The company has just completed its second dam at Croton on the Muskegon River, 17 miles below the first dam, known as the Rogers Dam. It now has one line to Grand Rapids and Muskegon at 70,000 volts and is erecting a second line, which will operate at 100,000 volts.

The company is seeking a franchise in Grand Rapids and has agreed with the City Council on power and lighting rates far below those prevailing in any other city of the size in the country. However, the franchise is to be submitted to a vote of the people and the company is determined to make sure of its passage. Three excursions have been run from the city to Croton, a distance of 35 miles. In each case the company chartered a special train of the Pere Marquette Railroad Company. The first excursion carried city officials and some of their friends; the second carried merchants of the city, and the third the manufacturers. In each case there were about 250 in the party. The start was made from the city in time to permit of a short look around at the dam and power house before dinner. En route plenty of cigars were provided to keep the crowd good natured, and local manager H. W. Hillman, general manager George Erwin and vice-president Foote and others of the company saw to it in person that each of the crowd was well cared for. Just before the company's property was reached the officials of the company distributed cards bearing the following information:

"Croton Dam foundation about 3000 oak piles and two rows heavy interlocking steel sheet piling, 30 ft. to 36 ft. long, driven 6 ft. below the bed of the river. Concrete piers, 42 ft. high. Concrete apron extends 200 ft. below dam, 4½ ft. to 2½ ft. thick, heavily reinforced with steel. Eight steel flood gates 13 ft. x 20 ft. each. Bear trap, 40 ft. long. Power house building, fireproof; protected from backwater by heavy concrete walls. All concrete work heavily reinforced with steel. Thirty thousand barrels cement and 1250 tons steel used in construction work. Concrete core wall about 300 ft. long and 42 ft. high set on a foundation of interlocking steel sheet piling driven 30 ft. to 36 ft. below bed of river. Two generators that will develop 7000 horse-power each. Wheel shafts 12-in. steel, 110 ft. long, 8 waterwheels on each. Current at generator 6600 volts. Will be transformed to 100,000 volts. Pond 1600 acres, 9 miles long."

After viewing the plant, the visitors were invited to the company's house where on the lawn tables were spread under a great canopy and the entire party was seated at once. A farmer dinner was served that would make glad the heart of any man with a healthy stomach. After dinner the party broke up to pursue its own pleasures. Baseball games were organized, some returned to the power house to examine the plant more closely; others, with whom the officials desired to talk, lent a willing ear in such surroundings, while small parties were made up for launch rides on the company's lake in the company's launch, which makes 16 miles an hour. The departure each day was made in time to get the crowds home for 6 o'clock dinner.

These excursions were supplemented by six-column reports in the local papers written by the company's press agent and illustrated by cuts and maps. The leading local papers are also giving the company support in their editorial columns and the campaign is certainly creating sentiment in favor of the franchise.

GRAND RAPIDS-MUSKEGON POWER COMPANY'S WORKS AT CROTON.

A page article in a recent Sunday paper entitled "The House Without a Chimney," described the electric house, which was built by Mr. Hillman, when with the General Electric Company, at Schenectady. The article pictured the many uses for electricity in the home and was gotten up as a news feature.

A feat which perhaps most pleased the visitors at the com-

pany's plant because it was well within their comprehension was the sluicing in of about 150,000 cu. yds. of earth from a bluff to fill the old bed of the river and turn the water over the dam. Rip-rap work with poles was built, and between this and the core wall the sand was washed in with a hose, the water being pumped by two 100-hp motors. The operation required about 60 days, but with only three or four men engaged, all the electricity was, of course, generated at the upper dam.

The company is now building a new steel tower line to Grand Rapids for the 100,000-volt transmission line. The towers are set 500 ft. apart. The wires are suspended by a new style of insulation. The insulators, which are of porcelain, instead of being set on the poles are suspended beneath the cross-arms, five disks for each insulator, and these carry the transmission cable.

The power company, in its efforts to convince the people of the fairness of the new franchise, used an argument which touched the pocketbook last month. To each of its customers it sent with the monthly bill made out according to the rates under the old franchise of the Grand Rapids Edison Company, under which it is now operating, a bill showing what the amount would be under the new franchise. In every case it was lower than under the existing franchise and, consequently, was most convincing.

Electric Signs in Portland, Ore.

In an address recently delivered before the Sacramento convention of the Pacific Coast Advertising Men's Association, Mr. Bury I. Dasent, advertising manager of the Portland Railway, Light & Power Company, entered a strong plea for the use of electricity in advertising. Referring to the use of the electric sign in Portland, Ore., he said that this means of advertising has assumed such importance in the business-getting plans of progressive merchants that even staid and conservative concerns such as banks have been brought to a realization of its value. A prominent banking institution of Portland last winter broke away from its hide-bound traditions of conservatism and installed an electric sign of the "flasher and chaser" variety, bearing the legend, "We Pay Four Per Cent." It was something unique for an establishment so dignified, but what was the result? The day after its installation a stranger entered the bank and depositing $10,000, remarked, "I don't reside in your city—but I happened to see your electric sign last night, and was so impressed that I decided to open an account with you." This sign is a large and expensive one, but an officer of the bank has stated that the profits traced directly to its influence paid for the sign within eight days after its installation.

In many cities throughout the country, enterprising merchants have combined to secure the effective advertising of particular sections and streets by the adoption and installation of an especially efficient scheme of special street illumination, using incandescent lamps of high candle-power. Experience has shown that where a street, formerly dark and unattractive, has been so illuminated, a business reanimation has speedily followed. The city of Portland is now experiencing this renaissance of street illumination. The transitional movement in streets and sections so lighted is characterized by an unquestioned business revival, and as a result the Portland Railway, Light & Power Company is now engaged in the installation of these lamps in various sections of the city for business men who are interested in the stimulation of trade and the improving of the lighting in the vicinity of their places of business, and for the further purpose of beautifying and advertising the streets in which their stores are situated. It has been realized by the enterprising business men of Portland that this plan of special illumination forms an advertising feature of tremendous value, and one that is absolutely necessary if they would keep abreast of the times.

It is due to the electric sign that the business thoroughfares of Portland have advanced more than 200 per cent in brilliancy within the last year. To it the city owes its brilliant thoroughfares, and its air of metropolitan gaiety throughout the hours of the evening. With shops and streets ablaze with electric light many more people venture out at night, and if anything, the throngs are now greater after nightfall than in the daytime.

The electric illumination of Portland's shopping district constitutes a spectacle that is free for the enjoyment of all, and the great public loves spectacular effects, and will go a long way to see and enjoy them. Until this electric era began, the merchant put up his shutters or pulled down his shades when he closed the doors of his store. His expenses—rent, salaries, insurance, all went on, but his business stopped. That was the ancient way. With the modern way—the electric way—business no longer slumbers, for the store keeps glittering eyes open for trade throughout the lingering hours of the night, and whets the desires of the multitude by tempting displays under the glittering rays of the electric lamps.

Electricity in Amusement Halls.

By William H. Stuart.

All through the East, during the past year, there has sprung up like mushrooms over night, a lot of amusement enterprises. These are of the moving picture, penny-in-the-slot and the small vaudeville show variety, and all use electricity to a great extent for illumination, for advertising and for the operation of the different machines.

Their outside appearance varies with the ideas and tastes of the proprietors and the amount of money to be spent in their construction and range from the gorgeous electrical palace to the small store with its kalsomined walls and sand-covered floor.

The better ones have a ceiling studded with a great number of incandescent lamps, with the walls set off with plaster art groups containing many small candle-power lamps, frosted or colored, according to the nature of the design. Here and there placed on the floor will be found in some, unique and novel electrical devices to amuse. On the outside of the building, signs of all sorts and arc lamps, as a rule, of the flaming arc type, blaze out in the darkness of the night. The cheaper

NIGHT ILLUMINATION OF AMUSEMENT HALLS.

ones are lighted by clusters or single incandescent lamps run across the ceiling. Outside will be found installed a panel sign, or one or two arc lamps, or outline lighting. The large and the small depend upon their electrical display to attract attention, and the brighter their premises look the better is their business prospect.

Their burning hours average about six every day, being from dusk until 12 to 1 a. m. There are a great many which operate through the day from 1 p. m. on, and use all their lighting equipment except that outside. This is desirable business, as they use every unit, comparatively none of the equipment lying idle. A great many companies encourage this class of business and offer a great many inducements to them, such as lower rates, equipment and service.

In the smaller ones the proprietors find that they cannot, on

account of the cost, model their establishments after the larger ones. Their thought turns to anything that will set out in as much light as possible, with the least expense, their premises. Naturally, to begin with, the place is painted white, and where any other coloring is added, pink or light blue is used, nothing darker. In some cities where panel signs were furnished by the lighting company, these were hung over the sidewalk about the center of the store, with an arc lamp each side of it. Later the panel signs were removed and a painted steel or iron sign substituted. They considered that the electrical panel sign used energy unnecessarily when the arc lamps were burning. In the hall proper Gem or Nernst lamps have taken the place of the clusters and incandescent lamps to a great extent.

The manager of an amusement company which controls the larger ones in a great many cities throughout the United States said that his company was always on the lookout to install another one anywhere the situation warranted it. They used one general style of architecture, shown in the accompanying illustration. Their difficulty, he said, was on the rate question, for to make any kind of display they had to have a low rate. In some cities this ran as low as 5 cents and in others as high as 9 cents per kw-hour. In the matter of lamp renewals, as a general thing frosted lamps were not renewed for them. To have the incandescent lamps conform with the general design it was necessary to have frosted lamps, a few colored and some special ones, and they had to frost and color the clear glass lamps that were exchanged free of charge.

In a city of 200,000 the average monthly consumption of one of this concern's amusement places was 1850 kw-hours, the equipment was 100 16-cp equivalents. The matter of the electrical equipment was carefully gone over and the size of the installation kept down to the minimum, as they were on the kw-hour demand rate with a low second-hour rate. In the same city an independent concern was constructed along the same lines, but of smaller dimensions with a larger equipment, 175 16-cp equivalents, whose average monthly consumption reached only 1250 kw-hours. The smaller ones in the same city, with an equipment of 75 16-cp equivalent on the regular rates, have a consumption of from 700 to 800 kw-hours.

Scattered all through New York City are a great number of these small amusement halls, some blocks having as many as five of them. All through the cities lighted by the Public Service Corporation in New Jersey there are groups of from five to 20 of them. The commercial department of the Public Service Corporation considers them one of the best business propositions they have when compared with the ordinary installation of 100 16 candle-power. The advertising the company gets from such installations is, moreover, considered to be of greater value than that received from the average store.

Electric Signs in Seattle.

BY H. COLE ESTEP.

It is claimed that there are more electric signs in the city of Seattle, per capita of population, than in any other city in the United States. One of the striking features of the city, always noticed by newcomers, is the brilliancy of the illumination of the business district at night, due largely to the profuse use of the electric signs. The electricity for most of these signs is furnished by the Seattle Electric Company, and a short account of how this department of the company's business was developed follows.

NIGHT SCENE ON FIRST AVENUE, SEATTLE.

The distinctive feature of the sign business-getting policy of the Seattle Electric Company is that this department has paid a reasonable profit from the start. While many central station companies are at first forced to conduct their sign business at a loss and are required to rent signs, give them away, install them for nothing, or offer thirty-day free trial in order to build up a paying sign load, this company has been able, by virtue both of local conditions and of the method of business-getting pursued, to conduct the sign department on a paying basis from the beginning.

The campaign was started two and a half years ago. In the beginning a reasonably cheap and efficient design of sign—namely, the Chris-Wallin porcelain trough type—was adopted as a standard. This type was selected because its comparatively low first cost and the low cost of operation made it easy to introduce. After the business was on its feet the more

elaborate and expensive signs, such as the Federal type, were introduced.

With a good sign to start with, the next step was to employ an expert, an experienced sign-business solicitor. This solicitor selected one progressive merchant in each line of business and concentrated on him until he agreed to take an electric sign. Once he was secured, his competitors followed suit, as a matter of course. In securing the first customer the electric sign was presented to him from the standpoint of a profitable advertising proposition that he could not afford to be without. This main point was emphasized, hammered on and illustrated by experiences and testimonials from merchants in his particular line in other cities. No special rates for his sign energy were offered, nor were the signs offered to him at less than cost; he was induced to buy them outright at a fair price. In short, the electric sign was presented, not as a new venture that needed special low rates and other inducements to make it acceptable, but as a standard, paying business proposition both for the merchant and the electric company. This line of attack met with eminent success and resulted in the conditions noted in the first paragraph of this article.

As is seen from the accompanying illustration, a night scene on First or Second Avenue in Seattle compares very favorably with one on Broadway, above Twenty-Third Street, in New York. The City Council has passed an ordinance which requires all electric sign owners to take out a permit and compels them to burn the lamps every night until 1 a. m. This insures a full illumination of the business district throughout the evening and gives steadiness and dependability to the sign load.

Under the stimulus of the sign department of the Seattle Electric Company many large sky line signs, visible for miles across the sound, have been erected. The most notable of these is that of the Seattle Hardware Company, which is 6 ft. high and 300 ft. long. It cost $1,000. This example, together with the fact that there are 50,000 lamps in electric signs in Seattle—one sign lamp for every five inhabitants—indicates the intensiveness and success with which this field has been cultivated in the Queen City of Puget Sound.

Electrical Decorations at San Jose, Cal.

By E. E. Pomeroy.

San Jose having been selected as the headquarters for the recent "Native Son's" celebration, the city decided to use electricity for decorative effect at night, and the electric light tower,

FIG. 1.—ELECTRIC TOWER AT SAN JOSE, CAL.

standing in the heart of the city, was utilized in carrying out part of the plan. This tower, which is about twenty-five years old and something over 200 ft. in height, is built mostly of iron pipe and braced with heavy wire; it is used ordinarily for street lighting purposes, carrying fourteen arcs at the top.

As will be seen by Fig. 1, the tower was strung with incandescent lamps, 1300 16-cp lamps being used. The wiring was

FIG. 2.—STREET SCENE AT SAN JOSE, CAL.

divided into sixteen circuits of No. 12 wire and arranged for 110 volts, the primary potential being 2200 volts. Six men were engaged about four days on the work.

Fig. 2 shows the method of lighting the main streets.

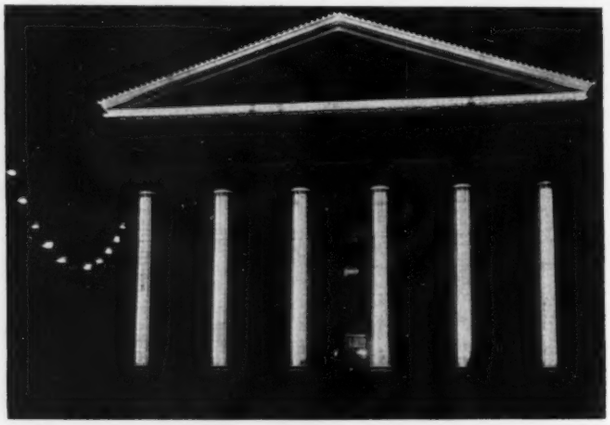


FIG. 3.—COURT HOUSE ILLUMINATION.

Lamps of 16 cp were strung in festoons of thirty each and covered with red paper lanterns; in all about 3500 lamps were used. Fig. 3 shows the electrical decoration of the court house. The electrical decorations were designed and installed under the supervision of city electrician John Guilbert, with the assistance of Frank Fall, as foreman.

Electric Street Decorations for Holidays.

The Boardman River Electric Light & Power Company, of Traverse City, Mich., has issued this summer as postal cards two interesting views of its lighting decorations made specially for July 4. We reproduce the cards herewith, thinking that

FIG. 1.—STREET SCENE AT TRAVERSE CITY, MICH.

possibly some of our other central station readers might also find the idea effective in business-getting.

These streamers were put up for the National holiday, and it was intended to take them down again promptly; but their

brilliant appearance made them quite popular, and a subscription was taken up to cover the expense of letting them remain in position during the summer months.

The company informs us that it used for this work bare No. 10 copper wire. The circuits carried 8-cp Shelby lamps with the "9171" receptacle, and the lamps were placed 24 ins. apart. The streamers were installed about 200 ft. apart, and this spacing made the street seem a blaze of light. Altogether, the company had up 1000 lamps of 8 candle-power, distributed

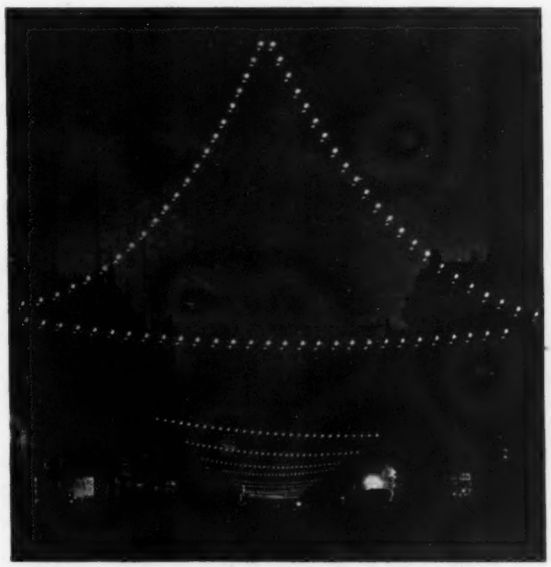


FIG. 2.—DECORATIVE STREET ILLUMINATION AT TRAVERSE CITY, MICH.

through the main streets of the town. The people were very much pleased with the effect, and photographs were in brisk sale, while there has been a great call for the postal cards. The zigzag streak of light down the middle of one of the postal views was caused by an automobile coming along the street toward the camera at the time of the exposure. The two views are taken from opposite ends of the street.

Point System of Paying Solicitors at Dayton, Ohio.

The Dayton Lighting Company, at present writing, is about to adopt the point system of paying its solicitors a commission. The system is a modification of that used by the Denver Gas & Electric Company, and described by Mr. C. N. Stannard, secretary of that company, in the ELECTICAL WORLD of April, 1906. At Denver, 5 per cent of the increase in gross revenue for each month of the year, as compared with the corresponding month of the previous year, is divided among the solicitors as commission, the division being in proportion to the number of points each solicitor has secured. The same plan is to be followed in Denver, except that the percentage of increased gross receipts to be divided among the solicitors has not yet been fixed.

Under the point system when a solicitor brings in a new contract, he is credited with a certain number of points, based upon the estimated gross revenue which the new business will bring in. The business which is most profitable to the company counts more points, however, than the class of business yielding the same gross revenue which is not so profitable to the company. Long-hour business, calling for the smallest investment per dollar of income, is credited with the highest number of points. The classification or schedule adopted at Dayton for crediting the solicitors is as follows:

CLASSIFICATION.

A.—Signs, outlining, motors, irons and cooking appliances, 10 points per $1 of yearly gross revenue.

B.—Windows operated according to the company schedule, also fans or any additional business secured on present installation, not otherwise classified, 9 points per $1.

C.—Dead service revived; must have been out of commission at least three months, 7 points per $1.

D.—Residence lighting and new contracts of any kind requiring an extension of service, 5 points per $1.

E.—Where meters are installed within three months from date of removal, 1 point per $1.

Successions or transfers secured by the representative, personally, are counted as 100 points, but no points are given on the revenue, unless added business is obtained; then such additional business is estimated according to the above schedule.

RULES FOR ESTIMATES ON REVENUE.

All flat rate contracts are estimated according to the contract price less the cost of the wiring, etc.

For meter customers the revenue is estimated as follows:

All-night lighting, 80 kw-hours per 16-cp lamp or equivalent per year.

Midnight lighting, 60 kw-hours per 16-cp lamp or equivalent per year.

Ordinary store lighting, 30 kw-hours per 16-cp lamp or equivalent per year.

Residence lighting, 20 kw-hours per 16-cp lamp per year.

Electric irons in residences, $10 per year, and according to consumption for other uses.

Motors, fans, etc., are to be estimated according to the place at which they are installed, and the length of time during which they are operated. All motor estimates must be approved by the motor specialist.

OUTLINE LIGHTING REVENUE ESTIMATES.

For 4-cp lamps when wiring is paid for by the consumer, $2 per lamp per year. The company is to furnish the first installation of lamps, free renewals, attention and switching service. When the company does all the wiring the price will be $2.75 per lamp per year. Outline lighting will be used as follows:

March 1 to Oct. 15, from dusk to 11 o'clock.

Oct. 16 to Feb. 28, from 5:30 to 11 o'clock.

Total hours per year	1625		
Net kw-hour rate	5	cents	
Switching charge	10	"	
Renewal charge	5	"	per kw-hour
Wiring charge	75	"	per lamp per year
First lamp installation	10	"	based on a 2-year contract

SIGNS, REVENUE ESTIMATES.

Assuming all sign lamps to be of 2 candle-power, the necessary connections to the present wiring to be made by the consumer, and the company furnishes the first installation of clear or frosted globes, free renewals, attention and switching service, the revenue will be estimated at 40 cents per lamp per year. The sign lighting is assumed to be operated during the same hours as the outline lighting noted above.

WINDOW LIGHTING REVENUE.

Where the consumer places the switch outside of the building subject to the approval of the company and it furnishes the switching service to him free of charge, agreeing to turn on the window lamps every evening at dusk and to switch them off at 11 p. m., the rate will be $.0635 per kw-hour with a discount of 5 per cent.

A Help in Explaining Equitable Rates for Electrical Energy.

Mr. D. W. Low, general manager of the Alliance (Ohio) Gas & Electric Company, in order to explain to some of his customers the reason for the necessity for charging more for electric energy when the use is only one or two hours per day than when it is used many hours per day, got up the following estimate on a door factory intended to produce a certain number of doors per year. This estimate shows the fixed and running expenses of such an establishment and the cost per door with the different rates of production per day. This example is one designed to be more easily understood by ordinary power

users and business men than an explanation which refers to apparatus and involves the use of terms about which the average consumer knows little.

The expense of running this door factory is divided into fixed and running expenses, and Mr. Low's figures show that the cost of producing doors may be anything between $2 and $14.62 per door, depending on the number that is being produced. These figures are such as might well be used by the commercial departments of some other companies in handling complaints as to rates and explaining the reason for high rates to short-hour consumers.

PLANT CAPABLE OF MANUFACTURING 15,000 DOORS PER YEAR.

Investment.			
Real estate			$5,000.00
Building and machinery			15,000.00
Items.	Standing.	Running.	Total.
Interest, 6 per cent	$1,200.00	000.00	$1,200.00
Depreciation, 5 per cent	750.00	000.00	750.00
Insurance, 4 per cent	600.00	000.00	600.00
Management and sales	3,000.00	000.00	3,000.00
Office expenses	230.00	000.00	230.00
Coal	000.00	$400.00	400.00
Engineer	600.00	000.00	600.00
Oil, waste and supplies	000.00	75.00	75.00
Water	000.00	25.00	25.00
Lumber	000.00	18,000.00	18,000.00
Repairs	150.00	50.00	200.00
Glue	000.00	120.00	120.00
Factory labor	000.00	4,050.00	4,050.00
Three men at $1.50	000.00	000.00	000.00
Three men at $3.00	000.00	000.00	000.00
Freight	000.00	750.00	750.00
Total cost, 15,000 doors	$6,530.00	$23,470.00	$30,000.00

COST PER DOOR, FOR DIFFERENT OUTPUTS PER DAY BASED ON ABOVE

Per Day.	Output, Per Year.	Standing.	Running.	Total.
50	$15,000	$.435	$1.565	$2.00
25	7,500	.87	1.565	2.43
10	3,000	1.306	1.565	2.87
1	300	13.06	1.565	14.62

LETTERS TO THE EDITORS.

Hopkinson Method of Charging for Electricity.

To the Editors of Electrical World:

SIRS:—Referring to the letter of Mr. Arthur Williams in your issue for Sept. 7, I would say that I believe that the Philadelphia Edison Company was the first to practically use the "Hopkinson" method in the United States, although the writer had never seen it.

On page 251 "Finances of Gas and Electric Light and Power Enterprises," is given a table first published in the proceedings of the Association of Edison Illuminating Companies, 1891. The closing paragraph of this letter to his board of directors (page 252) shows that the writer had been using this method successfully for a year before Feb. 17, 1891, and was anxious that the profitable results of putting electricity at 15 cents per kw-hour, and giving discounts as high as 47 per cent for long hours of use, as well as motors used all day at 5 cents per hp-hour, should not be lost to his company upon his retiring from its service. In 1896 the matter of minimum charges was treated algebraically (see "Finances," page 162), although the problem was privately solved by the writer in 1890. On page 134 of "Finances" is given another presentation of the "Hopkinson" method, published Oct. 15, 1900.

NEW YORK. WM. D. MARKS.

To the Editors of Electrical World:

SIRS:—Mr. Arthur Williams, writing in your issue of Sept. 7, in regard to the "Hopkinson Method of Charging for Electricity," states that "the Hopkinson or any similar method under which a minimum charge is placed upon the installation places a premium on the use of the service in other than the most necessary manner, and to that extent retards the development of the industry."

It seems hardly fair to Dr. Hopkinson to assume that he advocated the inequitable and inexpedient charge based on the customer's installation. The following quotations from his presidential address of 1892 show very plainly that the maximum demand of the customer and not the installation was in his opinion the proper basis of charge.

"The ideal method of charge, then, is a fixed charge per quarter proportional to the greatest rate of supply the consumer will ever take, and a charge by meter for the actual consumption. Such a method I urged in 1883, and obtained the introduction into certain Provisional Orders of a clause sanctioning a charge which is calculated partly by the quantity of energy contained in the supply and partly by a yearly or other rental depending upon the maximum strength of the current to be supplied."

"In certain recent cases in which I am acting as engineer, the Board of Trade have sanctioned on my application, for each unit per hour in the maximum power demanded, a charge not exceeding £3 per quarter, and in addition for each unit supplied, a charge not exceeding two-pence."

BOSTON, MASS. J. S. CODMAN.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Efficiency and Voltage Drop.—The Oerlikon Company recommends the defining of efficiency and voltage drop as follows: The efficiency of a machine or of a transformer which is built for a normal rating of A kilovolt-amperes, with a power factor $\phi = \cos \phi$, is defined as the ratio of $A \cos \phi$ to $A \cos \phi + v + i_1^2\tau_1 + i_2^2\tau_2 + i_2 c$, where v is the no-load loss in kilowatts at normal voltage, frequency and speed, after deducting all copper losses due to the no-load current and no-load excitation in the windings; $i_1^2\tau_1$ is the copper loss in the primary winding which has the total resistance of τ_1 and carries the current i_1 at the load A; $i_2^2\tau_2$ is the corresponding value for the secondary winding, τ_2 being its total resistance without transition resistance of the brushes. Finally $i_2 c$ is the loss which occurs in machines with commutators or slip-rings and represents the loss due to the transition resistance; for carbon brushes the mean value $c = 0.002$ is to be selected. τ_1 and τ_2 are the resistances for 60 degs. C. The losses $i_1^2\tau_1$ and $i_2^2\tau_2$ are determined by simple resistance measurements. The exciting current i_0, which corresponds to the load current i_2, is found from the characteristic curve of the machine. For a generator the no-load loss is best determined by driving it as a motor and measuring the power consumption. The efficiency of motor-generators is also to be determined according to the above definitions. The efficiency as defined above has a higher value than the real efficiency, since the above definition excludes all so-called additional losses due to armature reaction, etc. The exact measurement and calculation of these losses is generally impossible, and for modern machines this loss is small and is within the limits of errors in every efficiency test. The voltage drop e of a machine or of a transformer which is built for a normal rating of A kilovolt-amperes, a power-factor $\cos \phi$ and a normal voltage, E, is the difference between E and voltage $E + e$ at no-load for that excitation and speed which are required to produce the normal voltage at full load with the required power factor. For transformers the voltage drop at unity power factor is very nearly equal to the voltage drop in the ohmic resistance of the windings; $c = (i_1^2\tau_1 + i_2^2\tau_2) \div i_1$. The voltage drop of transformers for $\cos \phi = 0$ is determined by the voltage e at the terminals which is required to produce the normal current i_1 in the primary winding at normal frequency, if the secondary winding is short-circuited. With poly-

phase and single-phase generators it is in general difficult to provide a full load at exactly the required power factor, but by making use of a slightly excited unloaded synchronous motor it is often easy to load a generator with full-load current at normal voltage, whereby, of course, cos ϕ is approximately zero. In stations with two or more generators this test is very easily carried out. If a voltage drop c_2 has been found for a certain excitation from the no-load characteristic curve with a current i at $\cos\phi = O$, experience has shown that it is permitted to find the voltage drop for the same current and for a different power factor, by means of the Kapp diagram. This diagram is reproduced and the method of using it is described. For testing the insulation of high-tension windings the Oerlikon Company recommends, whenever possible, to generate the testing voltage in the windings themselves and to connect successively each of the terminals of the windings with the frame and a terminal of the low-tension winding. In this way the insulation of the winding itself, the insulation from the frame and the insulation from the low-tension winding are obtained. The testing voltage is applied in the form of alternating e. m. f. for 30 minutes. If it is not possible to generate the high-tension in the machine or transformer itself; a special testing transformer must be used, one terminal of which is connected with the frame and the low-tension winding, and the other terminal with the high-tension winding which is being tested. It is advisable to insert a resistance or an inductance coil between the high-tension winding and the testing transformer to avoid dangerous arc or short-circuits on the machine under test. In any case, it is necessary to measure the testing voltage at the electrodes by means of a spark-gap which has been calibrated with an alternating voltage of pure sine wave. The arrangement recommended in the standardization rules of the American Institute of Electrical Engineers (1902-3), using a spark-gap between two needle points, has been found very satisfactory in practice.—*Elek. u. Masch.*, Sept. 1. ,

Determining the Losses in Motors.—C. F. SMITH.—A paper illustrated by diagrams in which the author deals with the methods in use for obtaining a separate determination of the iron and friction losses in direct-current and alternating-current motors. The advantages and disadvantages of the various methods are described. Special attention is devoted to the testing of alternating-current motors.—Lond. *Electrician*, Aug. 30.

Lamps and Lighting.

Helion Lamp.—W. G. CLARK AND H. C. PARKER.—Some notes on their helion lamp. Most of the information given is already known. It is stated that conclusive life tests have not been completed upon the low-candle-power filaments of small cross-section, but life tests made upon filaments of greater cross-section for higher-candle-power filaments at one watt per candle operated up to, in one case as high as 1270 hours, and on a number of filaments upward of 700 hours, and in each case the drop in candle-power was very small—only about 3 per cent. In each case the lamp failed at, or near, the joint where the filament was united to the platinum leading-in wires. The cement used for uniting the filament to the platinum acts upon the filament. For this reason the authors are at present engaged in the development of a cement for making a joint which will not act on the filament.—*School of Mines Quarterly*, July.

Metallic-Filament Lamps.—Notes on two recent British patents. According to a patent granted to the German Welsbach Company, the common refractory metals, such as molybdenum, tungsten, vanadium or tantalum, in the form of filaments pressed from the powdered metal with an addition of organic binding materials, are heated in an atmosphere containing both nitrogen and hydrogen, but no oxygen. This serves to remove the carbon in a gaseous form while retaining the metals in a metallic state. A patent granted to Siemens & Halske relates to the production of ductile tungsten from powdered tungsten. The powdered metal is stamped into an iron tube, the tube is closed and subjected to a drawing or rolling process. The shell of iron is then removed chemically, and the rod of tungsten heated electrically in an indifferent atmosphere until it becomes sufficiently ductile. —Lond. *Elec. Eng'ing*, Aug. 29.

Twin-Carbon Arc Lamp.—An illustrated description of a new twin-carbon arc lamp of the British Thomson-Houston Company with long burning hours and specially constructed for use in places where corrosive fumes are present, such as foundries, etc. The lamp has two arcs in series within the enclosed globe and consumes about the same power as the 5-amp. series multiple lamp. It gives a perfectly steady white light. The carbons are placed close together, and to the observer the effect is the same as if the light emanated from a single arc. The negative carbon holder is so arranged that no shadows are caused. The carbons used are 10 mm in diameter and with 12-in. upper and 5-in. lower, the lamp will burn approximately 100 hours. The lamp is designed to operate singly on from 200 to 250 volts direct-current circuits and can be adjusted from 2.75 to 3.5 amperes.—Lond. *Elec. Engineering*, Aug. 15.

Public Arc Lighting.—F. TEAGUE.—Tables giving details on public arc lighting in various British cities, especially concerning the number of lamps used, the type, the method of trimming etc. The notes on trimming are especially complete.—Lond. *Elec. Engineering*, Aug. 23.

Test of Three-Phase Plant.—A description of the official tests of three steam alternators just constructed for the Great Cobar Copper Mines in Australia. The sets were tested on the specified power factor of 0.85. For the official tests two of the sets were connected as shown in Fig. 1. One set was run under steam as

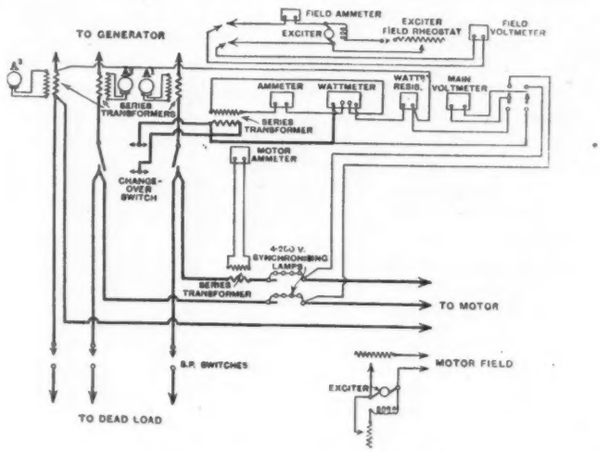


FIG. 1.—TEST OF THREE-PHASE PLANT.

a generator, and the other acted as a synchronous motor working in parallel with a balanced water load. The pistons belonging to the engine of the second set were removed and the set run up to speed, to allow of its being synchronized with the generator by means of a 30-hp direct-current motor belted to the flywheel of the engine. The necessary current for this was supplied from the works power plant. The arrangement proved very flexible, as by varying the field on the synchronous motor it was possible to obtain any power factor on the generator from zero lagging to about 0.85 leading. The actual power-factor during the official tests was 0.85 lagging, for which the generators were designed. In cases where two generators of a similar type are to be tested the adoption of this arrangement has the advantage over the use of choking coils that, once the connections are made, no time is lost in making adjustments to get the right power factor, since the only alteration required is to the series regulator in the field of the machine used as synchronous motor. The following is a summary of the results of this test, the readings showing the great advantage of using variable expansion gear on the high-pressure cylinder, there being only a difference of ¾ lb. per kilowatt between 20 per cent overload and half load. The steam consumption per kw-hour, condensing, was 22.4 lbs. at full load, 22.7 lbs. at three-quarter load, 24.0 lbs. at half load and 23.25 lbs. at 20 per cent overload. The governing results showed a rise of only 2½ per cent permanent and 4½ per cent momentary variation.—Lond. *Electrician*, Sept. 6.

Oil Engines.—An illustrated account of an exhaustive test which has been recently carried out to determine the oil-consumption of a 500-hp Diesel oil engine by M. Longridge, chief engineer to the British Engine, Boiler & Electrical Insurance Company. The guaranteed consumption was 0.45 lb. of 18,000 B. T. U. oil per hp-hour, and the test figures came out at 0.348 lb. for full load, 0.303 lb. for half load and 0.304 lb for quarter load. The half-load figure is equivalent to a thermal efficiency of 47 per cent.—Lond. *Elec. Eng'ing,* Sept. 5.

Electric Cranes.—H. H. Broughton.—The first of a series of articles on electric cranes. The author summarizes the advantages of electrically driven cranes and points out their superiority over the hydraulic system. A summary is given of comparative tests of hydraulic and electric cranes, the results of these tests being given in great detail in form of tables.—Lond. *Electrician,* Sept. 6.

Traction.

Tramways and Motor Omnibuses.—H. M. Sayers.—An article in which the author discusses the relative advantages of tramways and motor omnibuses for public passenger service on the basis of cost of service. It is shown that, as the cost of a motor-omnibus service is nearly proportional to the car miles run, while the cost of a tramway service is partly made up of charges dependent upon the cost of equipping the route, irrespective of the service run upon it, there must be some density of service for any particular case at which the route charges make up the difference between the car mileage costs of the two vehicles. For a denser service the tramway is the more economical. Working out this principle with figures derived from experience, the result is generally that, wherever the traffic promises to make a tramway remunerative, it is more economical than the motor omnibus. It is also pointed out that, where traffic fluctuates widely during the day, or over a year, omnibuses may give a better result than tramways, owing to the route charges of the latter having to be put against a too small car mileage. Attention is drawn to certain costs due to the use of the roads, which fall upon the rate-payers in the case of the omnibus, while tramways contribute directly to the rates, being assessed upon their tracks; tramways also maintain a considerable part of the road surface, and these items must be taken into account in ascertaining the true total cost of each service. It is finally suggested that the much better utilization of the street area by vehicles running upon rails must be taken into account where street congestion renders the best use of the streets an important economic consideration.—Lond. *Elec. Eng'ing,* Sept. 5.

Accidents.—A report of the British Board of Trade on the number of persons killed and injured on the railways of the United Kingdom during 1906. The totals upon electric railways, through contact with the "live" rail, are four killed and twenty-one injured. In addition, sixteen employees and one person on business were injured by shock and burn, not caused by direct contact with the "live" rail, and four were injured (one fatally) in generating stations.—Lond. *Elec. Eng'ing,* Aug. 29.

Installations, Systems and Appliances.

Tariffs of Charging for Electrical Energy.—An editorial summary of the various tariffs employed by British supply stations. The maximum demand system of charging is favored very considerably, the upper limit being frequently 14 cents and the lower limit 4 cents, although there is a good deal of variety. For example, there are the limits 14 and 6 cents, 12 and 6 cents, 14 and 8 cents, 12 and 5 cents, 14 and 3 cents, and so on. This variety, of course, is natural enough, because the stand-by charges and running charges must both vary considerably with the size of the undertaking and with local conditions. The maximum-demand system is undoubtedly correct in principle, but it is generally inadvisable to give this system without any alternative, and consequently any number of systems more or less simple are found in addition. Thus Buxton, besides having a rate of 14 cents for the first hour and 6 cents after the first, has rates of 12, 8, 6 and 5 cents. Some towns have simply a flat rate, others having a sliding scale with limits. Hornsey gives a rate of 10 cents with rebates, and Hertford includes free wiring if 16 cents and 4 cents are paid in place of 14 and 4 cents. A difference of price according to the voltage of supply is noticeable in one or two instances. Thus Hove gives a supply of 220 volts for 14 cents and 8 cents, but for a supply of 110 volts the charge is 16 and 8 cents. Similarly, Kensington gives a supply at 200 volts for 10 and 6 cents, but charges 12 cents for a 100-volt supply. Halls are charged at 7 cents and churches at 6 cents at Govan. At Horsham churches have to pay 10 cents, while at Hackney a 6-cent rate is allowed. At Whitehaven the charge is based on $40 per kw-year and 4 cents per kw-hour, whereas at Norwich a yearly charge is made of 12 per cent on the net assessment, and a further charge of 2 cents per kw-hour. Flat rates, in addition to being subject to rebates, are frequently quite complicated. Thus at Westminster the first 1000 kw-hours are charged at 11 cents and the next 3000 at 9 cents, and after 4000 the charge is 7 cents. St. Pancras, again, has a number of different charges. The flat rate with or without discounts is unfair. In addition to the different tariffs for lamps, there are further rates for motors. Generally speaking, the published rate for motors is a flat rate of from 2 cents to 4 cents per kw-hour; though, as a matter of fact, large consumers are always considered on their merits and prices are arranged in accordance with load factor and quantity. In addition to a flat rate, some supply authorities graduate the charge according to quantity; thus Woolwich supplies 10,000 kw-hours at 4 cents and 40,000 kw-hours at 2.5 cents. Some authorities make the more rational charge of a certain sum per kilowatt of demand per year and a low rate per kw-hour. In the case of a small demand for motors, as well as for lamps, the complications may arise that a consumer desired the charges of the maximum-demand system for his lighting load, and also requires a certain amount of energy for motors and heaters. If he wishes to take advantage of the maximum-demand rate for lighting and of the lower rate for heaters and motors, he must pay for two meters and put in duplicate wiring. On the other hand, if he avoids duplicate wiring and has only one meter, it is practically impossible for him to make use of the maximum-demand system. Finally, the advantages of the use of a time-switch are pointed out. If two meters were installed and a time-switch to change over from one meter to the other during times of peak load, or the equivalent arrangement of a single meter with a shunt, then all the energy used during the greater part of the day and registered by one of the meters might be charged for at quite a low rate, and that used during the time of peak could be charged at a comparatively high rate. It is quite immaterial to the suppliers of electrical energy for what purposes the electrical energy is used during times of light load. Such a system has the disadvantage that it takes no account of load factor, but it has the advantage of simplicity, and the further advantage that it would tend to encourage the small user of electricity for motors.—Lond. *Electrician,* Aug. 30.

British Central-Station Account.—An abstract of last year's report of the Borough of Stepney electric station. The general tendency of British electricity supply authorities to reduce their rates, especially to power consumers, has in some cases led to disastrous results. In the case of Stepney, however, a substantial reduction in price per kw-hour for both motors and lamps has actually resulted in a larger surplus than last year. This has been effected by a reduction of the works cost of generating electrical energy, this reduction amounting to about 10 per cent and having been accomplished by economies in the use of coal. The total coal used during the year was 9366 tons, of which 4000 tons were best smokeless Welsh, costing $18,000, and used principally for carrying the heavy load during the few hours each evening, while the balance of more than 5000 tons consisted of cheap bituminous slack, costing $15,000, and was used throughout the greater part of the 24 hours. The total expenses, including capital charges, etc., per kw-hour were 3.54 cents, while the corresponding total revenue from all sources was 3.74 cents.—Lond. *Elec.,* Aug. 30.

Manchester.—The conclusion of the illustrated description of the three-phase power supply of the Manchester municipal station. The present installment deals especially with sub-stations. In certain installations both alternating-current and direct-cur-

rent are needed from the three-phase mains, and both stationary transformers and rotary converters are required in one sub-station. The number of power consumers on the three-phase mains at present is 10, and the rating of the sub-station plant installed is 7160 kilowatts. Some 3800 kilowatts of this total is in motor-converters and the balance in static transformers. The combined consumption of the 10 firms is over 12,000,000 kw-hours per year. Among the present three-phase customers are two spinning mills, a wire works, a locomotive works, armor-plate works, chain works, electric-motor makers, machine-tool makers and chemical works. The motors installed in these works range in size from 7.5 to 150 horse-power.—Lond. *Electrician,* Aug. 30.

Transformers for Adjustable Resistances.—G. BENISCHKE.—Voltage regulation in alternating-current circuits is preferably carried out by means of adjustable inductance coils, but they cannot always be used. For instance, for charging mains when a long cable containing considerable capacity is to be gradually switched on to a high-voltage supply, the use of an inductance coil would be dangerous, since the variation of the inductance from a high to a low value would probably lead to resonance conditions at some point. For this purpose, therefore, non-inductive regulation must be employed, and, if the handling of apparatus in the high-tension circuit is to be avoided, a transformer connected as in Fig. 2 and whose secondary is gradually

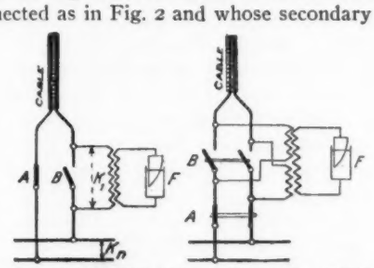


FIG. 2.—TRANSFORMERS FOR ADJUSTABLE RESISTANCES.

short-circuited by a liquid or other resistance *F* may advantageously be employed. For double-pole charging—such as is necessary in the case of concentric mains—the modification shown in the right-hand diagram is suitable. The action of such apparatus depends on the fact that the primary of a transformer behaves like a choking coil, with an impedance which decreases as the secondary load is increased, so that more current is allowed to pass to the mains. The maximum choking action occurs when the secondary is on open circuit, and the minimum when the secondary is short-circuited; the voltage across the primary in the latter case being the short-circuited voltage of the transformer, which is only a small fraction of the open-circuit primary voltage. The distinct advantage of this method over choking-coil regulation lies in the fact that, whereas with the latter the ohmic resistance remains constant and only the inductive resistance varies, with the transformer both resistances vary simultaneously, and it is possible to alter the amount of variation of each by altering the nature of the secondary load. Further, the ohmic resistance of a choking coil is comparatively small, while the corresponding equivalent ohmic resistance of the transformer, both on open circuit and with a non-inductive secondary load, is large compared with its inductive resistance. By never actually opening the secondary circuit, and by using the correct maximum secondary resistance, it is possible to insure that the resonance conditions cannot occur.—Lond. *Elec. Engineer,* Aug. 16.

Electricity on Farms.—D. S. PAXTON.—A profusely illustrated account of the numerous applications of electricity for industrial purposes at a farm in Saxony. A system of high-and-low-tension wires has been erected, and portable transformers and motors can be connected to it at numerous points. Electric motive power is employed for threshing, saws, pumping and distributing manure, etc.—Lond. *Elec. Eng'ing,* Aug. 29.

Electric Equipment of an Asylum.—A description of the equipment for light and power purposes of extension of the lunatic asylum of the London County Council.—Lond. *Electrical Engineering,* Aug. 29.

Switchboard.—O. SPITZER.—A fully illustrated description of the new switchboard in the station of the International Electric Company in Vienna. Use is made of the system of Klingenberg, in which the different instrument panels are not firmly fixed on the main frame but are movable. All instruments and apparatus which belong to one machine or to one cable are placed on a car running on rails in a closed chamber of the main board. This enables one to disconnect single groups of instruments from the switchboard by simply running the corresponding car out of the board so that revisions and repairs are not made in the high-tension room, but in front of the switchboard.—*Elek. u. Masch.,* Sept. 1.

Starting Switch.—Details of construction with illustrations of a recently patented motor-starting switch of E. F. Moy, which is of the hand-operated, magnetic-clutch variety.—Lond. *Elec. Eng'ing,* Aug. 29.

Rules.—A full reprint of the complete set of regulations of the German Association of Electrical Engineers for erection of electric installations for light, power, etc., with a notation which is recommended for electrical drawings.—*Elek. Zeit.,* Sept. 5.

Regulations.—Extracts from the new sets of safety regulations of the German Association of Electrical Engineers.—Lond. *Elec. Eng'ing,* Aug. 29.

Wires, Wiring and Conduits.

Soldering.—A. LIPPMANN.—The conclusion of his article on the rôle which acid plays in solders. He shows that it is possible to make solders which contain much less organic acids and are more suitable for soldering than rosin, so that the recommendations of the latter material by the German Association rules is not warranted. To compare the advantages of different solders, tests of the acid content, of the attack on metals, mechanical tests, etc., are recommended. Electrical tests (for instance, resistance measurements) may also give information concerning the quality of the solder, but they require too much time.—*Elec. Zeit.,* Sept. 5.

Fuses.—G. J. MEYER.—An abstract with illustrations of his recent German paper on the phenomena during the blowing of a fuse, and on the German regulations as to fuses.—Lond. *Electrician,* Aug. 30.

Electrochemistry and Batteries.

Purification of Water.—H. LEFFMANN.—A Franklin Institute paper on direct and indirect methods of electric purification of water. In direct methods electrolysis is applied with aluminum electrodes. Aluminum hydroxide is formed which has the effect of combining with the organic matter and entangling the suspended substances, so that the water after treatment can be subjected to a rapid filtration and will show material improvement in microbic content, especially if the amount of suspended matter and microbic content were previously high. For waters containing but little suspended impurity, the purifying action is relatively low. The consumption of the aluminum electrode is a serious item of expense. As an indirect electrical method, he mentions the sterilization of water by means of electrically produced ozone, and gives some data on the experimental plant which was in use with the Vosmaer process in Philadelphia. Many tests of the bacteriocidal efficiency of the ozone plant have shown that the water as discharged from the ozonizer was practically sterile, exact figures being given in formulas and tables.—*Jour. Franklin Inst.,* Aug. and Sept.

Charging Plant for Storage Batteries.—An illustrated description of a charging plant for electric automobiles. The switchboard measures 11 ft. by 3 ft. and has mounted at the back of it a field rheostat for the dynamo, with hand-wheel in front. A reverse cut-out is fitted to prevent the accumulators discharging through the dynamo in the event of the latter accidentally stopping. The main ammeter and voltmeter are 9 in. in diameter and of the dead-beat, moving-coil type, reading up to 175 amperes and 75 volts respectively, while there are 20 ammeters of 6 in. diameter for the charging circuit. The resistances are fitted in separate porcelain units for each step, and may be easily replaced. There are double-pole main switches and fuses, with a safety fuse to each circuit. The dynamo is capable of a normal output at 70 volts of 160 amperes. It is pos-

sible to charge at one time 275 accumulators with 100 amperes at 4 volts, the normal rate being 7 amperes, with a possible maximum of 10 amperes if necessary. The dynamo runs at 960 revolutions per minute.—Lond. *Electrician*, Sept. 6.

Units, Measurements and Instruments.

Current Meter.—W. W. Lackie.—A description of a device for measuring electric currents. As shown in Fig. 3, a maximum-current indicator comprises a pivoted lever, *C*, connected to the core of a fixed solenoid, *A*, so as to be tilted when a certain current passes. The tilting connects a wheel, *F*, carried by the lever, with a wheel of the counting train of a watt-hour or other meter, so as to move a weight along the lever till the latter is tilted back. The position of the weight indicates the

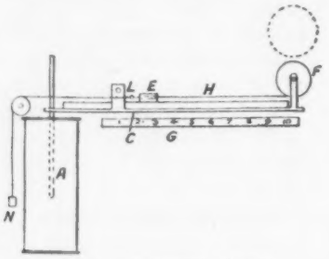


FIG. 3.—CURRENT METER.

current strength. The time taken to tilt the lever back is approximately the same for all currents, and depends on which wheel is used as driving wheel. According to the specification the lever is trough-shaped, and the driving wheel may belong to a clockwork, driven electrically or by a spring so as to make the apparatus complete in itself. In the arrangement shown the wheel, *F*, winds in a cord *H*, which passes through the weight, *E*, and moves it by a stop, *L*. When the lever tilts back the cord is unwound by a weight, *N*, leaving the weight, *E*, for its position to be read from a scale, *G*, on or separate from the lever. The cord may be fixed to the weight, *E*, the part to the left being omitted, but in that case a further increase of current would be recorded in a shorter time than the original current. Several modifications of this meter are also described.—Lond. *Elec. Engineer*, Aug. 23.

Optical Pyrometry.—L. Holborn.—A (British) Association paper in which the author first summarizes the fundamental laws of black-body radiation, namely, the Stefan-Boltzmann law for the total radiation, Wien's displacement law, and Planck's law for the radiation at a single wave length. Measurements of temperature can be based on any equations, but the most important one is the third law, especially in the simpler (and older) form of Wien. The fundamental constant in Wien's law has been determined with an accuracy which may amount to about 1 per cent so that temperature measurements (if the melting point of gold, 1064 degrees, is taken as the starting point) is accurate to 6 degrees at 1500 degrees C, to 16 degrees at 2000 degrees C and to 48 degrees at 3000 degrees C. Several types of optical pyrometers are briefly described. If an optical pyrometer which has been standardized by means of a black body, is employed on a body of smaller radiating power, not the true temperature is obtained but a smaller value which in distinction from the true temperature is called the "black temperature." For the noble metals such as silver, gold and platinum, special measurements of the emissivity have furnished a simple result. The emissive power (relative to that of a black body, at the same temperature) for those metals for a given wave-length in the visible region is independent of the temperature within the accuracy of the measurements of temperature. Thus platinum emits red light of about one-third, gold of one-eighth, and silver of one-fourteenth of the brightness of a black body at the same temperature. The law is valid down to low temperatures where we can determine the emissive power from the absorption of good metallic mirrors. —Lond. *Electrician*, Aug. 30.

String Electrometer.—T. Wulf.—Two silvered quartz fibers are suspended side by side and joined and weighed at the bottom. They are surrounded by a conducting vessel, which is charged to a certain potential. The fibres diverge even when earthed, since each fibre is in an electrostatic field formed by, say, the positive charge of the nearest wall, and the negative charge on the other fibre, due to induction. This arrangement has the advantage that positive and negative charges have an opposite effect upon the divergence. The scale of the instrument is quite independent of the potential to which the outer vessel happens to be charged. The deflection is simply proportional to the difference of potential between the fibres and the conducting vessel, which behaves like Faraday's ice pail. Very high potentials can be measured with the instrument, so long as a proper auxiliary potential is available. On the other hand, the sensitiveness of the scale is preserved down below one volt, so that even fractions of a volt can be measured. Herein the instrument is distinctly superior to the gold-leaf, which ceases to act below some 70 volts.—*Phys. Zeit.*, Aug. 15; abstracted in Lond. *Electrical Engineering*, Sept. 5.

String Galvanometer.—G. Zemplen.—A note on the observation of alternating currents with a string galvanometer.—Lond. *Electrician*, Sept. 6.

Testing Machine.—C. E. Larard.—An illustrated paper describing in detail the construction of a new testing machine which is capable of great precision of control with respect to the time rate of straining and loading, either slowly or very quickly over a large range. The control obtained in this machine for torsion as well as the more usual tests of tension, compression, and bending, is due to the use of two electric motors with wide-speed range, the high range in the rate of straining by hydraulic pressure, and the fact that the handle and other adjustments are controlled from one position.—Lond. *Electrical Engineering*, Aug. 15.

Testing Dry Cells.—F. Stahli.—An illustrated description of a simple switchboard for measuring simultaneously by means of a single galvanometer and a single ammeter the voltage and amp-hour rating of dry cells.—*Elek. Zeit.*, Sept. 5.

Electric Welding.—An illustrated article on the Thomson process of electric welding and various modifications of it which have recently been developed. A new method of uniting the surfaces to be joined as in the left-hand diagram of Fig. 4. These projections set up local heating, and when they are at the right temperature they are welded together by pressure. A method of forming joints in thin material is as follows. The strips are butted in the clamps of the welder in such a way that when heated and pressed together the edges are turned up against each other, as shown in the right-hand diagram. An automatic hammer is then used to force the upturned edges down against the strip, and to press the heated metal to about the same thickness as the original strip. An extremely strong and satisfactory joint is the result. A Thomson electric-welding machine, specially adapted for the manufacture of hollow handled table cutlery, and a method of electrically welding wire

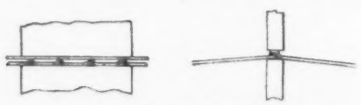


FIG. 4.—ELECTRIC WELDING.

netting, also the manufacture of square and hexagon-headed bolts by electric welding, etc., are described. Finally, a transformer specially designed for welding purposes by Berry and Wallis Jones is noticed and illustrated.—Lond. *Electrical Times*, Sept. 5.

Telegraphy, Telephony and Signals.

Wireless Telephony.—Majorana.—A paper read before the Italian Electrical Association describing his new system of wireless telephony, which is based on the use of a spark gap. For generating the spark a special rotating arrangement is used by which it is claimed 10,000 single sparks per second can be obtained. In wireless telephony there is required a microphone that can be used with high-tension currents. It must be capable of withstanding a pressure of several thousand volts and of carrying a considerable current. These conditions

gave rise to the Majorana hydraulic microphone, which depends on the capillary properties of fluid jets. A stream of liquid flowing from a suitably constructed opening divides itself into drops which follow each other at practically constant intervals. The frequency may be noticed acoustically by allowing the drops to fall on an elastic membrane which then gives out a sound of corresponding frequency. When mechanical oscillations are superimposed on the fluid jet periodical constrictions may be noticed which are of very nearly the same frequency as the superimposed oscillations. The drops thus force the membrane on which they impinge to give out sounds of a corresponding frequency. If the drops fall on a level surface at right angles to their direction, a covering of thickness, varying with the frequency of the drops, is formed. Prof. Majorana has constructed a microphone on this principle and has thus obtained telephonic currents of extraordinary clearness and strength. This microphone consists of the usual mouthpiece and of a membrane fixed to a glass tube which moves freely under the oscillations of the membrane and through which slightly acidulated water flows. The liquid passes out of a special opening in the glass tube and strikes the upper surface of a "collector," consisting of two cylindrical pieces of platinum insulated from each other. On striking the middle of the "collector" the fluid spreads itself over the surface and puts the two halves in permanent connection. Thus a battery whose poles are connected in circuit with a telephone and this "collector" will send a constant current through it so long as the membrane is not affected by sound waves. When the membrane vibrates the aperture begins to oscillate, and varies the flow of the drops so that the fluid on the "collector" is continually altering in thickness. If this circuit is connected in a suitable way with the spark-gap mentioned above, the intensity of the spark will correspond with the sound waves and will transmit to the receiving station the appropriate words and sounds. Prof. Majorana obtained good results with this experimental arrangement, but found it advantageous to use a Poulsen arc in nitrogen instead of the spark-gap.—Lond. *Electrician*, Aug. 30.

Miscellaneous.

Effect of Electricity on Plants.—J. H. Priestley.—A paper read before the British Naturalists' Society in which the author gives results of the experiments with the overhead discharge system of electrification. This method has a distinct effect, usually favorable in character, upon the growth of plants. Experiments with earth currents showed occasionally an increase in the rate of plant growth, but often there was no definite effect.—Lond. *Electrician*, Sept. 6.

Meter Calibrating Equipment.

By William Bradshaw.

The watt-hour meter being the apparatus which definitely determines the revenue on which the success or failure of the operating company depends, it is highly important that it be kept permanently in correct calibration. To accomplish successfully and economically this purpose requires two lines of standard instruments, which are usually designated as primary standards and secondary standards.

The primary standard may have a great many useful features, but the essential one must be permanence of calibration. With this feature obtained, the standard should in addition be unaffected by uniform external magnetic fields, accurate on either alternating or direct-current circuits, astatic, cover a wide range of currents and voltages, convenient to use and of a semi-portable type.

The primary standard may contain all of these features and still be of little value to the central station if it will not stand shipment when properly packed without destroying its calibration. The central station must from time to time verify the calibration of the standard, and not having the means at hand for this work, it must ship the meter to some standard laboratory or Government bureau of standards. Rarely can the instrument be delivered to the standardizing laboratory by messenger, hence must, to be of any value, be so constructed as to be shipped by express without mechanical injury or damage of calibration.

A line of primary standards, or precision instruments, have been in use for a number of years, and through the medium of a free calibration service for a period of five years, the manufacturer has been able to keep accurate and reliable records of the permanence of each instrument's calibration and general performance of the meter. The number of instruments in constant use, record of whose performance has been kept, runs into the hundreds, and every one has made one or more round trips between the customer and the manufacturer's laboratory without a single failure due to shipment. The average performance of permanence of calibration has been a change not exceeding .1 to .2 of 1 per cent.

From the above it will be seen that the central station has available a line of primary standards with all the essential or important features of a laboratory standard; but which, regardless of frequent shipment by express and movement from place to place by the user, is just as permanent in calibration, retains its zero setting equally well and has greater inherent range of current and voltage than the average laboratory standard.

A precision meter which has the preceding characteristics and qualifications is illustrated by Fig. 1. This particular meter

FIG. 1.—PRECISION WATT-HOUR METER.

illustrated is especially adapted for testing watt-hour meters on account of wide ranges of current and voltage for which it is adapted. Three maximum current ranges of 5, 20 and 100 amperes each are covered by this one instrument, and its shunt circuit is so designed that it requires 1000 ohms per 100 volts; hence its range on voltage is limited only by the amount of external resistance used. With the 100-volt resistance in use the meter will measure, with an accurancy well within the limits of error given by the formula on the certificate of calibration shown in Fig. 2, values from 10 to 10,000 watts. With other resistances the range of watts measured will be in proportion to the resistance used.

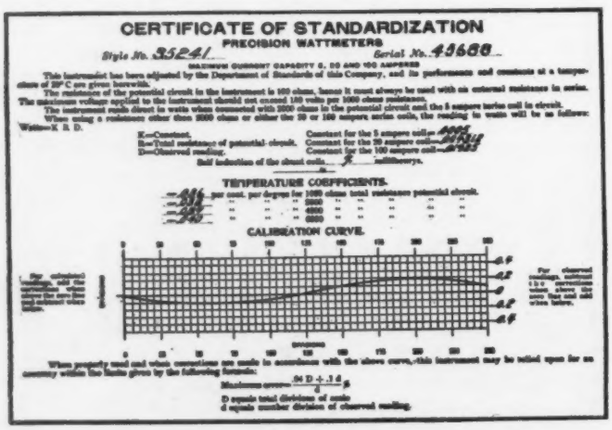
The coil system consists of two movable and four fixed coils. Each movable coil is placed between two fixed coils and the connections of the coil system so arranged that each movable coil is attracted by one and repelled by the other of these fixed coils. This arrangement prevents any mutual induction between the two sets of coils.

The instruments are zero reading; that is, the movable system is deflected from its position of rest when current passes through the coils, and the indications are read from the deflection required of a spiral spring to return the movable system to the zero position. By this construction it is possible to place the coils close together and make them of such a

form as will give the greatest torque with minimum expenditure of energy in the coils; also with this form a minimum of disturbing influences enters.

The scale covers an entire circle approximately 5 ins. in diameter, and this is again virtually multiplied in length ten times by providing the deflecting pointer with a vernier which permits reading to 1/10 of each of the 200 main scale divisions or 1 in 2000 parts.

The certificate of calibration illustrated in Fig. 2 gives a representative calibration curve for one of these meters. This curve shows the variable relations between the defiction of a spring and the torque required to produce this deflection. Only


CERTIFICATE OF STANDARDIZATION

PRECISION WATTMETERS

Style No. 35241 Serial No. 43668

TEMPERATURE COEFFICIENTS.

CALIBRATION CURVE.

FIG. 2.—STANDARDIZATION CERTIFICATE.

by the use of two controlling springs is it possible to keep this variation down to a negligible value or 1/10 of 1 per cent. With the best possible single spring this variation will usually exceed 1 per cent for some point of the 360-degree scale.

The secondary standard used should furnish an accurate, convenient and economic method of line calibration of service meters. Secondary standards, with which the line test can be easily and accurately made, are now available in the form of special watt-hour meters variously known as test meters, master meters or preferably portable watt-hour meters. The method of this line test consists in comparing the speeds of the moving element of the service meter and the portable watt-hour meter. The difference in revolutions between what the standard meter should make if the service meter were correct and what it actually does make for a given number of revolutions of the service meter, divided by the number of revolutions the standard makes for correct registration of the service meter, gives in per cent the accuracy of the service meter; that is, the per cent registration of the service meter.

When the full-load speeds of the discs of the service meter and the standard meter are the same, these data are obtained direct by taking the difference between the two speeds for a given time and dividing this difference by the speed of the service meter for the time taken. If the speeds of the two meters under full load are different it is necessary to use a constant.

Fig. 3 shows a portable watt-hour meter arranged for this class of service. It has four current capacities of 5, 10, 20 and 40 amperes and two voltage capacities, namely, 100 and 200 volts. The meter may be arranged for any one of the series capacities by a simple plug board on the face plate of the meter and for either of the voltage capacities by changing the leads on the face plate to the left of the voltage connections. The meter is arranged to record on its dial the revolutions of the disc and also an additional index indicates 1 revolution to 25 of the disc. The special features in this design are series coils made up of sections which are connected in series-parallel groups for the various capacities, thus giving the same load characteristic for any one of the four capacities and a high torque for light weight of moving element.

In making a test using this meter as a standard, the standard meter is connected in series with the service meter under test, care being taken to place the series connection for the standard meter on the load side of the service meter and the voltage connection of the standard meter on the line side of the service meter, this connection preventing either meter measuring the shunt energy of the other. When thus connected a load approximating full load or 4 per cent of full load is connected and a comparison made of the speeds of the two meters, the standard meter being started and stopped as desired by a small snap switch in the shunt circuit of the same.

This method of testing service meters is very simple and one man alone can test a large number of service meters per day, as compared with any other method. When used with discretion this method gives very accurate and reliable results, but there are a few limitations to the meter which should be borne in mind when using it for test purposes. To obtain the best results it is advisable, although not absolutely necessary, that the load and voltage characteristics of the service meters being tested be known. If these characteristics do not agree in general with those obtained from standard makes of watt-hour meters, there is a possibility of considerable error being introduced in the calibration of the service meter. If the different capacities of the series coil are not obtained by a series-parallel arrangement of sections of the coil, there will be considerable difference at various points on the load characteristic in the per cent registration of the various capacities. An allowance for this difference in per cent registration must be made in calibrating the service meter if a standard is used having this type of series coil. It is recommended that tests be made on the service meter at loads approximating full and 4 per cent of load. If calibration is made for the light load at 10 per cent of full load or over a calibration which will be within 2 per cent at this point might be 5 or 6 per cent, or even more, plus or minus at 2 per cent of full load. The error in setting in some instances may even cause the instrument to creep on shunt alone. For this reason it is advisable to calibrate at the lower rating, as stated above.

Many central stations will take all of the precautions cited and make the serious error of considering the portable watt-hour meter as a primary instead of a secondary standard; that is, assume that the portable watt-hour meter is sufficiently permanent in calibration that it does not need any primary standard to which it is compared to keep it in calibration, or at least it is only compared at very rare intervals with such a standard. Many instances are known in which this type of meter has

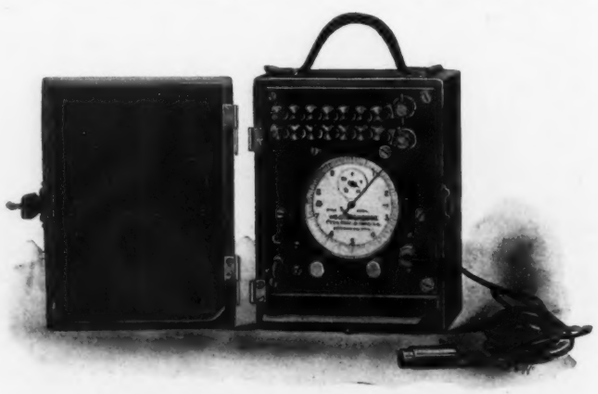


FIG. 3.—PORTABLE STANDARD WATT-HOUR METER.

shown remarkable performance, the calibration remaining practically constant over a long period, but the severe service to which this type of meter is subject in transporting it from one installation to another and installing it for test together with the liability to accident, such as short circuit, sudden jar, etc., makes it a very hazardous policy to rely solely on the calibration of the secondary standard, the only safe method being to have at hand a reliable primary standard of a type which will stand shipment and consequently can be sent to some bureau of standards for calibration at regular intervals and then make a practice of calibrating the portable watt-hiur

or secondary standard meter at very frequent intervals to prevent the changing of the calibration of service meters when they are correct and the standard is out of calibration.

It is the practice of some large central stations to check the secondary standard against the primary standard every day previous to starting out for a series of line tests on service meters. Others make this calibration check every three days, others at longer intervals, while a few are willing to take the chance and make no calibration whatever.

Arc Lamps for Use with Locomotives.

Fig. 1, herewith, which shows a lamp mechanism from which all complications have been eliminated, represents the results of a series of experiments conducted by Mr. B. B. Lacy for the Galveston, Harrisburg & San Antonio Railway Company with a view to simplifying the usual lamp construction and

FIG. 1.—LAMP MECHANISM.

rendering its operation sufficiently reliable to justify the general adoption of the device for locomotives. The bracket which supports the frame permits adjustment laterally as well as forward and back so as to bring the arc at the focal point of the reflector. The lower electrode of the lamp is made of copper ½ in. in diameter, while the upper is of carbon ⅝ in. in diameter. It

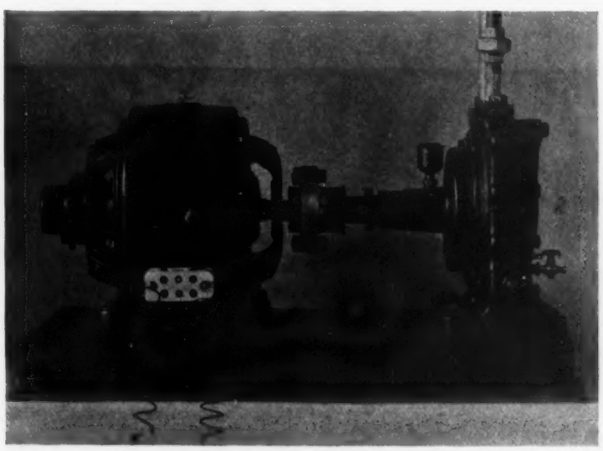


FIG. 2.—ROTARY ENGINE AND ARC LIGHTING GENERATOR.

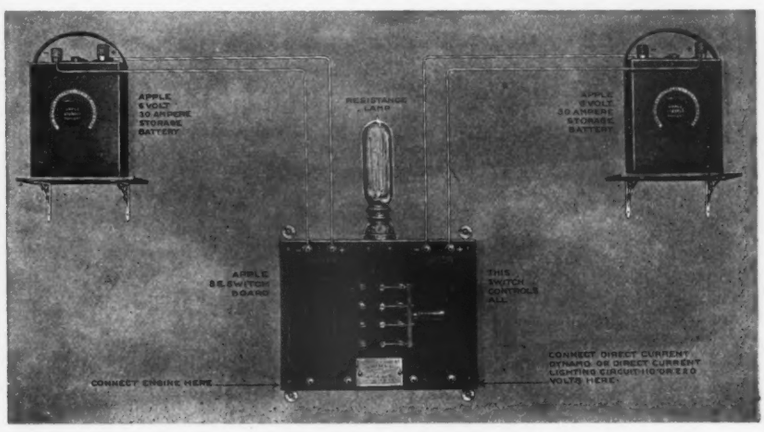
is stated that the lower electrode does not waste away appreciably, and that the arc is maintained at the same vertical point at the focus of the reflector. Direct current of from 12 to 17 amperes at a potential of 35 volts is furnished by an enclosed generator directly connected to a 2-hp rotary engine controlled by a governor which throttles the supply of steam and maintains the speed at 800 r. p. m.

Ignition Switchboard Outfit.

The Dayton Electrical Manufacturing Company, Dayton, Ohio, has placed on the market a new switchboard outfit, known as "Apple 8-s," for igniting gas engines used to drive direct-current lighting or power dynamos. The outfit is applicable wherever *direct current* (110 or 220 volts) is available, and is particularly suitable for use with stationary gas engines used to drive lighting or power dynamos (direct-connected and belted gas engine-generator sets); large marine gas engines with which a lighting dynamo is used, and gas engines located where a direct-current city lighting or power circuit is available.

The switchboard provides a means of charging two ignition storage batteries alternately from any 110-volt or 220-volt direct-current circuit, taken through a lamp of proper resistance, one battery being charged from the lighting or power circuit while the other is being used for igniting and vice versa.

As an e. m. f. of 110 or 220 volts is too high to be used


APPLE 6 VOLT 30 AMPERE STORAGE BATTERY
RESISTANCE LAMP
APPLE 6 VOLT 30 AMPERE STORAGE BATTERY
APPLE 8S SWITCH BOARD
THIS SWITCH CONTROLS ALL
CONNECT ENGINE HERE
CONNECT DIRECT CURRENT DYNAMO OR DIRECT CURRENT LIGHTING CIRCUIT 110 OR 220 VOLTS HERE

IGNITION SWITCHBOARD OUTFIT.

for recharging a low-voltage battery, it is necessary to take current through a resistance lamp to reduce it to the proper amount for recharging work. The resistance lamp used for thus cutting down the current is shown at the top of the switchboard in the accompanying illustration. The four-pole double throw switch mounted on the face of the switchboard breaks and makes all connections for transposing the charging and ignition currents from one battery to the other and does so positively, quickly and without the slightest complication. The entire operation consists simply of throwing the switch handle from one side of the board to the other.

Storage batteries unquestionably furnish the best current for ignition work, giving off the "fat," hot sparks so much desired for igniting the mixture of gas and air in the combustion chamber of the engine, and the switchboard shown provides a ready and inexpensive means for properly charging small storage batteries, thus keeping them at the highest point of efficiency at all times.

The outfit is easily mounted on a post or wall. The wires from both batteries are connected to the binding posts marked "Battery," wires from the engine to the terminals marked "Engine," and wires from the dynamo to the terminal marked "Dynamo," these being all the connections necessary. The one switch does the rest. Any touch- or jump-spark coils, timers and plugs of standard make can be used with the outfit. Its use lengthens the life of the points in a touch-spark engine, for the reason that when the switch handle is thrown on one side the current for ignition flows through the electrodes in the engine in one direction, and then when the switch handle is thrown on the other side, the current flows in the opposite direction. This distributes the platinum evenly between the two points in the engine or those in the coil and gives long life to the points, which is a very important feature.

Testing Set for Telephone Lines.

The lineman's testing telephone shown in the accompanying illustration has been designed for testing long-distance telephone lines, or any other form of circuits that do not carry high-voltage currents. It is especially intended for rough outdoor service. The apparatus is compactly aranged in a well-constructed, heavy oak box, reinforced at all corners by heavy cast-brass trunk corners.

The prominent feature is a one-half m. f. condenser in the receiver circuit to eliminate an exposed switch hook, for the

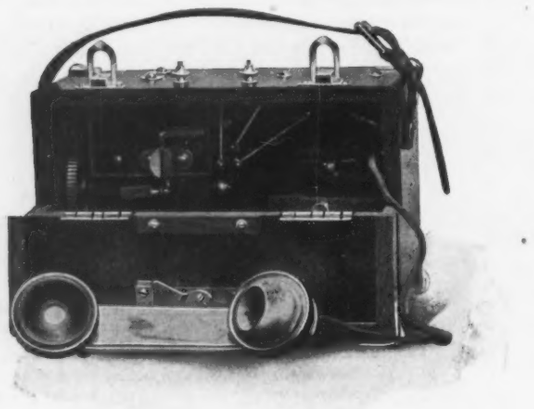


FIG. 1.—TESTING SET, WITH CASE OPEN.

purpose of breaking the line circuit. With this arrangement the instrument may be rung any time when on the line. The long type buzzer or ringer is not across the line when ringing out, and the generator shunts out the bell, putting the full voltage on the line when ringing with the generator.

The all-metal combination telephone forming a part of this equipment consists of a seamless brass tubing frame or handle and a transmitter and receiver containing the same size parts as are used in the regular long-distance equipment. All exterior sides and edges are carefully protected, and are enclosed as

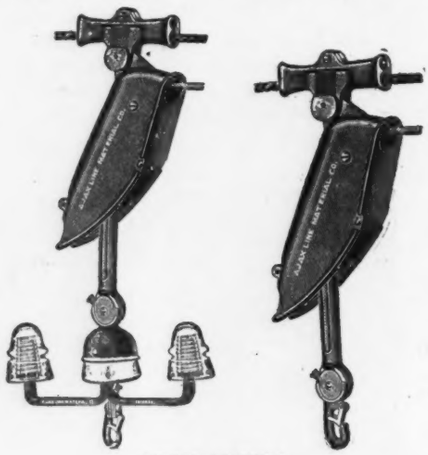
FIG. 2.—TESTING SET, CASE CLOSED.

much as is practicable. A transmitter cut-out button is arranged just opposite the receiver for preventing the annoyance of side tones taken up by the transmitter when listening in on the line in a noisy place. This button also cuts in the battery when necessary, or only when talking. In other forms of instruments not provided with button-switches as long as the receiver is off the hook, the battery is being consumed, which is unnecessary. All parts are thoroughly finished and well insulated. The Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., is the manufacturer of these instruments.

Ajax Safety Pulleys.

Four sterling qualities are claimed for the new safety pulley designed by Albert Scheible and marketed by the Ajax Line Material Company, of Chicago. It is simple, the only movable parts being the sheave and the knob to which the lamp is fastened. It is weatherproof, being housed as shown in the illustration. It is lamp-supporting, as guideways inside the casing guide the knob to and from a seat automatically, where it is supported independent of the rope.

It is smooth in action, avoiding sudden jars which would shake the carbons out of adjustment. This latter feature is attained



SAFETY PULLEYS.

by having the knob ride up an inclined guide when it first enters the pulley; then as the casing tilts, the angle between the knob and the guide soon becomes too steep for the knob to continue, thus stopping the knob without jarring it. Slackening the rope allows the knob to seat itself in the safety position, from which another pull on the rope releases it automatically.

The knob itself has the familiar Ajax snaphook for the lamp, and a clamp which readily grips either cotton or wire rope. For series circuits, the Ajax "Volta Arm" design for 10,000-volt work is fitted direct to the knob, as also pictured herewith. Both cuts show the Ajax safety pulley with a clamp for suspension strand, but it is also made with other styles of clamps for use on piping, beams or ceilings.

Speed Indicator for Drills.

The accompanying illustrations show a convenient device for determining the proper feed and speed of drills for both carbon

DRILL SPEEDS
FOR
WROUGHT IRON
MACHINERY STEEL
SOFT TOOL STEEL
REV PER MIN.
HIGH SPEED | CARBON
FEED PER REV 180 | 108
FOR DRILLS SMALLER THAN ½ INCH .004" TO .007"
LARGER THAN ½ INCH .005" TO .010" GET MAXIMUM
RESULTS BY OBSERVING CONDITION OF DRILL.
A CHIPPED EDGE INDICATES TOO HEAVY A
FEED, THE WEARING OF CORNERS INDICATES
TOO HIGH A SPEED.
THE C T.D. Co.

FIG. 1.—DISKS SET FOR SHOWING SPEED FOR 1 1/16-IN. DRILL.

and high-speed steel. The indicator consists of celluloid disks which are movable around a common center, the method of

use being self-evident from the illustrations. There are three disks, the combination of one side of the center disk and the corresponding outer disk indicating the proper speed for drills and the combination of the other side of the center disk and the corresponding outer disk showing decimal equivalents of

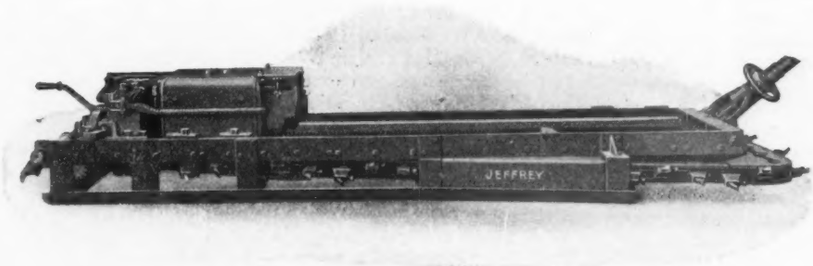
FIG. 2.—DISKS SET FOR SHOWING DECIMAL EQUIVALENT OF 1/16.

certain fractions. This device has been prepared by the Cleveland Twist Drill Company, Cleveland, Ohio, for free distribution to applicants.

Enclosed Mining Machine Motor.

The electric mining machine illustrated herewith has been designed for use in mines where explosive gases are encountered. The motor is of the enclosed type, and although it is given the same rating as that of the open type formerly used, it occupies no more space than the open-type motor.

It will be appreciated at once that the service to which mining motors are subjected is extremely severe. The equipment must withstand both oil and moisture, as well as heat and dirt, and yet it receives almost no attention. The motor here illustrated is provided with automatic ring-oiling bearings, which are so arranged that the oil hermetically seals the motor housing, and gas which may accumulate about the motor cannot be ignited by any spark within the motor. Over the commutator of the motor there is placed a plate-glass door,



ENCLOSED MINING MOTOR MACHINE.

protected by a heavy malleable-iron lid; the brushes may be observed through the glass door without exposing the motor to the mine gases. The starting switch is equally as well protected as the motor itself, all contacts being hermetically sealed in flame-tight metal casings.

The electric mining machine described above has been placed on the market by the Jeffrey Manufacturing Company, Columbus, Ohio. It not only conforms to the rigid rules and requirements of the British Government, but it requires the lowest possible expense for operation and maintenance.

Metallic Shield Blow-Out Controllers.

The arc-rupturing device in the controllers illustrated herewith differs from the ordinary magnetic blow-out device in two important particulars. The blow-out coil is constructed without any magnetic material in the flux circuit, and hence there

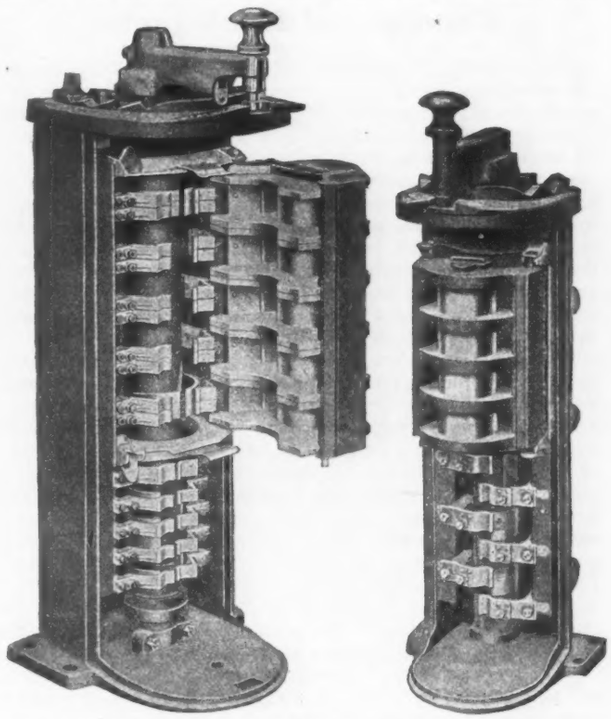


FIG. 1.—CONTROLLER WITH BLOW-OUT SWUNG OPEN.

FIG. 2.—BLOW-OUT IN PLACE ON CONTROLLER.

is no "point of saturation" beyond which the controller refuses to operate satisfactorily. The blow-out effect increases in direct proportion to the current, and consequently the more powerful is the arc the greater is the magnetic field for rupturing it.

The second distinctive feature of the controller resides in the use of a copper shield which is brought directly in the sweep of the arc. The external magnetic field created around the shield attracts the arc to the shield and divides it into two, one arc going from one contact finger to the shield and the other from the shield to the other contact finger. These two arcs travel rapidly in opposite directions and finally become united again in the air, but around the shield; the arc at this time has become drawn out to such an extent as to rupture. Under operating conditions the arc is swept around the shield with great rapidity, and it does not affect the metal in the slightest degree. Moreover, the arc travels in the center of the shield and the insulating partitions are not subjected to any injury from the flame.

Fig. 1 illustrates a metallic-shield controller designed especially for heavy, intermittent work, such as electrically operating rolling mills, wharf cranes and other machinery. This type has a rating of 200 amperes on continual service.

In Fig. 2 there is shown a 100-ampere controller with the blow-out in place. This type is intended for use with cranes, hoists, locomotives, etc., or for service where a light, compact and efficient controller is required.

The metallic-shield blow-out type of controller is manufactured by the Von Zweigbergk Controller Company of Cleveland, Ohio. The general sales office of the company is at 20 Broad Street, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The lower temperature favored the distribution of seasonable merchandise, and collections were more prompt; but agricultural prospects were not so bright in a few sections, where killing frosts were experienced. Reports of retail trade are favorable with scarcely an exception, the fall demand equalling sanguine expectations, and jobbers in all leading lines of wearing apparel report the season's results equal to last year's. Manufacturing returns are more irregular, but most plants are well occupied and have orders covering production for some months. Purchases for more remote delivery are restricted by the financial uncertainty, which tends to cause conservatism, especially in the East. Scarcity of labor retards work at many points, while other delays are due to strikes, of which several are in progress. There is also much complaint of car shortage, but not more than is customary at this season. Railway earnings in September thus far exceed last year's by 7.5 per cent, and foreign commerce at the port of New York for the week showed a gain of $1,890,283 in exports and a loss of $2,889,491 in imports, as compared with 1906. In the iron and steel trade, the quiet tone as regards new business is still the leading feature, though mills, furnaces and factories are still busy on old orders. New orders are reported by leading interests as running 25 per cent behind a year ago at this date. There is apparently more competition for new business offering in finished products. Business in structural material is dull, but contracts on long-delayed work are again being figured on. The tightness of money makes it difficult to close pending contracts. The decline in building activity has made lumber dull, and yellow pine and hemlock are easier at the West. Other materials are also easy, and hardware manufacturers are seeking orders, whereas a year ago deliveries could not be promised short of five months' delay. Copper is again lower, lake copper for future delivery being quoted at 14⅞ to 15 cents, while for electrolytic grades 14¼ to 14⅝ cents has been named. At the lower prices domestic demand for spot copper has improved slightly, while Europe has bought moderately for October and November delivery, but business, on the whole, is disappointingly dull and competition for orders is more in evidence. The closing quotations of the previous week were 14⅞c. for Lake, 14⅝c. for electrolytic and 14¼c. for casting stock. On Sept. 20 Lake closed at 15¼ cents, electrolytic 14⅞ cents and casting 14⅝ cents. *Bradstreet's* reports 166 business failures during the week ending Sept. 26, against 179 in the week previous and 165 in the corresponding week of last year.

PLANS FOR UNIVERSITY.—U. S. Consul L. E. Dudley, in the following report from Vancouver, tells of the plans for a new provincial university in that part of Canada: "The last session of the provincial Parliament incorporated the Royal British Columbia University, and appropriated 2,000,000 acres of government land, the proceeds from which are to be used in the construction of the necessary buildings and for the endowment of the university. According to the plans for the building to be erected on the university site at Point Grey, the specifications call for a two-story structure, 150 ft. long by 62 ft. in width. The competing architects will have to figure on accommodation for at least 300 pupils, administration offices, general lecture rooms and apartments for the special scientific subjects required for the two years' course in engineering, which includes chemistry, physical and biological laboratories. The design for the building will be chosen from those submitted in the competitive examination, for which $850 is being offered to architects. This amount will be divided into three amounts—$500 for first prize, $250 for the second prize, and $100 for third. It is proposed to expend about $100,000 on the first part of the construction, and, as conditions warrant, to double this amount. The competitive plans must be handed in by October, and are to serve as ideas upon which the definite building may be erected. The present plan for location calls for a building about 300 ft. from the water front, and equidistant between the boundaries of the university grounds. This will afford ample opportunity for the construction of wings and additions. It is understood that building will begin in the spring. The actual location of the university grounds is on the east side of the naval reserve, covering nearly 32 acres, with a water frontage of 800 ft., having a depth of 1600 ft."

PLATINUM IN COLOMBIA.—Writing from Cartagena, U. S. Consul I. A. Manning states that the platinum industry in Colombia seems to be attracting considerable attention from abroad, which causes him to supply the following report: "Recently a French company, headed by Albert L. de Lantreppe, of London, has made some heavy purchases of mining properties in the platina district. They are soon to send competent engineers to make a complete study of the region from which platina is taken at present, and especially of their properties. Other capitalists and companies have also recently secured large holdings, which they expect to develop more scientifically than has been usual in working the mines. It is said that these companies will make an effort to find whether platina is found in quartz deposits as well as in placer ground, the latter being the only source of the present supply. The platina of Colombia has been found only on the headwaters of the Atrato River and the Rio San Juan in the State of Cauca and near the Pacific coast of Colombia. Most of these deposits are also gold bearing and they have been worked for a good many years, principally for the latter metal, as only during recent years has platina assumed a value sufficiently great as to give this metal an important place in the market. There is still no doubt a very great expanse of country rich in minerals of all kinds and where platina must exist, which has never yet been prospected in a scientific manner. While a great deal of platina is exported through Cartagena and Barranquilla, the export from Buenaventura must be considerable."

PLANT AT SEATTLE.—It is now stated that the extensions to the municipal lighting plant will not be completed until next June, according to the present calculations of the city officials. A new 4000-kw generator is to be installed, however, by January, and this will enlarge the present capacity of the plant, which has reached its limit. "Work is in progress now on the pipe line from the lake down to the station," Superintendent Youngs says. "This line will be three miles long and we are starting on the rock work now. In a short time we will have a camp and boarding house installed to take care of the crew on the pipe line. One of the 4000-kw generators will be installed in January, if the contract is fulfilled. This will relieve the present congestion of business. The other generator will follow shortly. The new waterwheel should be in place shortly after the generators. By June we should have the pipe line finished and we can then run the new waterwheel and both generators. If we had not been held up for a year and a half in getting the money from the $600,000 bonds, our extensions would be completed. Both of the private companies have all of the business that they can handle and extensions to their plants have been delayed." The present municipal lighting plant has a capacity of 3500 kilowatts. The extensions will give it 8000 additional kilowatts. For the past few weeks applications for light have had to be refused by the lighting department, as the present plant can handle no more business.

PRICE OF COPPER.—The prices quoted on copper are still weak and low, and a good deal of satisfaction is felt in electrical industries that have suffered with a price pushed unduly up to 25 cents or more. The United Metals Selling Company and other large producers continue to quote copper at 15 cents a pound, although sales are reported a shade below that price. No large transactions have been made. The big consumers are still holding aloof from the market, and signify their intention of remaining out until they feel that the bottom has been reached. A large producing company says that in view of the fact that cost of production is now within a few cents of the selling price, a further heavy recession in prices would be unnatural.

NERNST LAMP COMPANY, Pittsburg, Pa., has closed a number of large contracts lately and has issued a special request for an early filing of orders, so that customers may not be disappointed as to deliveries.

CONTRACT FOR SUBMARINES.—The United States Navy Department has awarded the contracts for building $3,000,000 worth of submarines, which amount was appropriated by the last Congress. The final arrangement stipulates that the Electric Boat Company shall build four boats of the Octopus type at $285,000 each, three boats of the same type, but of larger displacement, at $360,000 each, that $230,000 shall be retained by the Department to pay for improvements on these boats and that $550,000 shall be withheld, to permit the Department to construct one or even two boats of a type other than the Octopus. This makes the way open for the Lake submarine boat to have another chance. It is generally felt that the decision amounts to giving the entire contract to the Electric Boat Company, as was the Department's intention when the board of construction and the board on competitive trials of submarine and subsurface boats unanimously recommended the Octopus or so-called Holland type. The long delay has served only to bring about a semblance of competition, as the government cannot leagally build any boat other than the Octopus type without further competitive tests or without an act of Congress. This statement was given out when the contracts were awarded: "In view of the explicit provisions of the act of March 2, 1907, the opinion of the attorney-general, the unanimous opinion of the board on comparative trials of submarine and subsurface boats and the unanimous recommendation of the board on construction, the department has decided to award a contract for four submarine boats of the Octopus type and three additional submarine boats, of the same type, though of greater displacement, to the Electric Boat Company, under the conditions as to reduced prices and guarantees for superior speed recommended by the board on construction, but has reserved from the total authorized appropriation of $3,000,000 a sum sufficient to permit the construction of one or even two boats of a type other than that reported favorably by the trial board, should it subsequently prove advisable to build such a vessel or vessels, the law leaving it entirely discretionary with the department as to how much of the total authorized amount of $3,000,000 should be obligated at this time."

AMERICAN STORAGE BATTERY COMPANY is a promising newcomer in the storage battery field. It is at present occupying the old electric light plant of the Cambridge Electric Light Company, Cambridge, Mass. The company was organized this year to manufacture a new type of storage battery, of which E. C. Eckstromer is the inventor. Mr. Eckstromer has devoted his life to this line of work, spending most of the time in Germany, and after years of study he perfected a type of storage battery which can be applied to any vehicle, and which, it is claimed, practically doubles the radius of action. The new company expects to apply its batteries to the new submarine boats now building at Quincy. They are also in demand for the automobile trade, as it is found that an automobile equipped with one of these batteries can go over 100 miles without recharging. The company has an automobile and a motor boat of its own for demonstration purposes. The president of the new company is Joseph C. Kent, of J. C. Kent & Company, bankers and brokers, Boston. The consulting engineer is Prof. William L. Hooper, of Tufts College. The old electric light plant is being equipped for the temporary occupation of the company, the experimental laboratory alone costing $25,000, but it is expected that within a year it will be in occupation of a factory of its own, to cover some 10 acres of ground. The location for this has not been definitely picked, but it will doubtless be in Cambridge, near the company's present location. Before long the company expects to have from 100 to 150 men at work on the manufacture of the batteries in its present plant. Very full tests and reports in regard to the battery have been made by Prof. Hooper and by Prof. John Stone, who has gone over the Hooper results. The battery is of the lead-lead pasted grid type, but by a special process the active material is rendered unusually porous and permeable by the electrolyte.

AN IMMENSE SWITCHBOARD.—The Westinghouse Electric & Manufacturing Company is now shipping the largest switchboard equipment that has ever been turned out, it is said. The cost alone is over $150,000. It has 100 panels. The various appliances, such as switches, voltmeters, ammeters, circuit breakers, lightning arresters and other apparatus connected with it, will be shipped in 200 boxes, each box measuring 3 ft. x 9 ft., and the entire load will fill four freight cars. This switchboard was made by the Westinghouse Company for the Rio de Janeiro Tramway & Power Company, of Rio de Janeiro, Brazil, which firm operates a water power plant known as the Brazilian Niagara, and which has a capacity of 40,000 horse-power. The energy is generated about 40 miles from Rio de Janeiro, to which city it is transmitted for light and power. The power house machinery for this plant was all constructed at the East Pittsburg works, and the shipment of the switchboard about completes the installation.

SUBMARINE SIGNAL.—The Submarine Signal Company, of Boston, has called attention to the fact that vessels equipped to receive submarine signals frequently save one or more days in making port, which means a day or more saving of interest on bankers' letters of credit, from 75 per cent to 90 per cent of such business being done on this class of credit. The North German Lloyd Company, which has 23 of its vessels equipped with submarine receiving apparatus, has arranged to have its vessels sailing to United States ports equipped. The Argo line, sailing between London, Bremen and Hull, is having three vessels equipped. The Panama Railroad Steamship line has arranged to have the receiving apparatus installed on its five steamships sailing between New York and Colon. To allow vessels to test the submarine signal apparatus, the Sandy Hook lightship is ringing its submarine bell continuously day and night, during September. The new *Lusitania*, of the Cunard line, is equipped to receive submarine signals.

UNLAWFUL TELEPHONES.—The Central District & Printing Telegraph Company, operating the Bell telephone system in Pittsburg and vicinity, has begun a campaign against agents who have been engaged in selling telephones and other appliances for use in connection with its lines. The officials of the company say that if some action is not taken to prevent the introduction of such apparatus, conditions in Pittsburg soon will be as bad as those in Paris, where each subscriber furnishes his own instrument and usually pays more attention to the ornamental effects on the outside of the set than to the value of the instrument for telephone purposes. It appears that at least one agent has made it his practice to represent to prospective customers that his apparatus is approved by the telephone company for use on its lines. The officials of the company point to a clause in the subscribers' contracts which directly prohibits the use of such apparatus.

ALLIS-CHALMERS.—The annual meeting of the Allis-Chalmers Company to have been held last week was postponed. This caused some criticism and a slight decline in the stock. Representatives of the company state that too much importance has been attached to the adjournment of the annual meeting. The postponement was not the result of any unsatisfactory development. It is generally known that some plan for strengthening the financial position of the company is being worked out, and other matters which have an important bearing upon the company, and which the management desires to make public at the annual meeting, are in course of settlement. It is understood that the earnings of the company for the first quarter of the present fiscal year will show that the turning point for the better has been reached. Some details of this were given in our columns last week.

NORTHERN CRANES.—The new power stations of the North Shore Electric Company, at Waukeegan and Blue Island, near Chicago, are furnished with alternating-current electric cranes furnished by the Northern Engineering Works, of Detroit, Mich. These cranes are 30 tons and 25 tons capacity, respectively, 58 ft. and 39 ft. span. The larger crane is equipped with an auxiliary high-speed alternating-current hoist. The Black Hills Traction Company has recently installed an 8-ton, 32-ft. span Northern traveling crane at Spearfish, S. D.

FOREIGN ORDERS.—It is stated that among contracts for the other side is one obtained by the Westinghouse interests for the electrification of the Rise Carr rolling mills, at Darlington, Yorkshire, operated by Sir Theodore Fry & Company, Limited —one of the oldest established concerns of its description in Great Britain. The contract includes a number of motors ranging from 400 horse-power to 5 horse-power. The complete plant will cost nearly $1,000,000.

THE BRISTOL COMPANY, Waterbury, Conn., is about to build another new addition to its present plant. It will be 53 ft. x 170 ft., three stories high. This further space is made necessary by the increased demand for Bristol recorders and Bristol patent steel belt lacing. With the amount of business in sight, it looks as though it would not be long before even this addition will be crowded.

ACTIVITY OF ELECTRICAL INDUSTRIES.—A special dispatch from Boston gives some of the facts as to the extent of the sustained activity in electrical manufacturing industries and says: "The reduction in working forces made by the three large electrical manufacturing companies during the last six or eight months has been far less than might be gathered from the somewhat disturbing reports circulated from time to time. The Western Electric alone of the three companies has made an extensive curtailment in the number of its employees, but the public has only a minority interest in the securities of the Western Electric Company. At the close of their last fiscal years, the General Electric, Westinghouse Electric and Western Electric companies employed upwards of 73,300 men. At present the names on the payrolls aggregate 63,200, a decrease of 10,200, or, say, 13 per cent, since the early part of the year. Fully 60 per cent of this decline, however, is contributed by the Western Electric Company, which sold in 1906 nearly $70,000,000 of telephone and general electrical apparatus, and has been obliged to restrict its output of electrical supplies on account of the very marked let-up in telephone construction and expansion this year. Below are shown comparatively the employees of each of the three companies at the end of the last fiscal year, the number now, the decrease and percentage of decrease:

	Employed Close Fiscal Year	Employed Now	Decrease	Percentage Decrease
General Electric	28,000	25,000	3,000	10.3
Westinghouse	18,386	17,200	1,200	6.5
Western Electric	27,000	21,000	6,000	22.2
Total	73,386	63,200	10,200	13.0

In spite of the reduction in employees the three companies have actually been able to turn out as much, and in the case of the General Electric and the Westinghouse companies, more gross business during the first six months of the current fiscal year than they did in the corresponding period of 1906. For instance, during the six months ended July 31 the General Electric billed a total of $35,406,878 of gross business, against $25,915,762 in the same portion of 1906. Comparison of the gross business of the General Electric and the Western Electric companies during the six months ended July 31 and June 30, respectively, 1907 and 1906, follows:

	Six Months, 1907	Six Months, 1906	Increase
General Electric	$35,406,878	$25,915,762	$9,491,116
Western Electric	30,000,000	31,000,000	*1,000,000

*Decrease.

The Westinghouse Company reports net income for five months of $3,548,886, or at the rate of about $8,500,000 a year. This indicates figures at least up to those of last year.

ALLIS-CHALMERS BUSINESS.—"Business may be falling off somewhere, but not here," said W. S. Heger, assistant to President Whiteside, of Allis-Chalmers, to a representative of the *Wall Street Journal,* whom he showed through the great plant at West Allis. "Our books are as far ahead as they were a year ago. One day within a fortnight we booked orders for $800,000 worth of work. Some departments are ahead an entire year. Orders are coming in better than last year." Inspection of plant fully confirms what Mr. Heger says. The only apparent difficulty is lack of working room, as the business has outgrown the capacity of the eight large buildings. The company owns 110 acres at West Allis, 34½ acres being under roof. Plant capacity is 11,000 horse-power. There are 102 traveling cranes, with combined capacity of 2010 tons. So many extra tools have been set on the floors to keep up with business that the workmen are crowded. There is plenty of room for expansion when the problem of working capital is solved.

TELEPHONE EQUIPMENT.—(1) Bids will be received until Oct. 23 by the Postmaster-General's Department, Sydney, New South Wales, Australia, to supply 11 tons galvanized iron wire (400 pounds per mile); 1600 best white porcelain insulators; 500 wall telephones. (2) Bids will be received until Oct. 30 to supply 55½ tons hard-drawn copper wire (300 lbs. per mile); 400 lbs. 3/16-in. wide copper binding tape (200 lbs. per mile); 3500 large, best white porcelain insulators; 1000 tallowwood cross-arms, 3 ft. 10 ins., with end bolts and straps, complete; 2500 of the same 5 ft. 2 ins. (3) Bids will be received until Dec. 11 to supply 1000 common battery wall telephones, 100 table telephones. Address for particulars, Commonwealth Offices, 72 Victoria Street, Westminster, S. W., London, England.

BECK FLAMING ARC.—The selling organization for the Beck flaming arc, under the name of the New York Beck Lamp Company, is no longer in existence. The entire business, inclusive of manufacturing and selling, is conducted by and in the name of the Beck Flaming Lamp Company, 30 Greenwich Avenue, New York City. Mr. J. H. Hallberg, the electrical expert and inventor, is now taking a prominent part in the management. The Beck Company has a fine exhibit at the Electrical Show this week, and its lamp has been adopted exclusively by the New York Edison Company for the interior and exterior illumination of Madison Square Garden. It can also be seen in the booths of the New York Edison, United Electric Light & Power and Driver-Harris Wire Companies.

THE STANDARD ROLLER BEARING COMPANY, of Philadelphia, Pa., has increased its capital of $3,500,000 to $5,000,000. Large additions are now being made to the plant and equipment for the purpose of enlarging its department for the manufacture of roller bearings for shafting hangers and also for the establishment of an entirely new department for the manufacture of roller bearings for trolley cars. The saving by the use of roller bearings on trolley cars amounts to about $300 a year per car, and the demand is so great that a large addition to the plant is required to take care of the business that is now rapidly increasing.

LOOMIS PETTIBONE CO., 2 Rector Street, New York, announces the incorporation of its new company, in which the partners are Messrs. Burdett Loomis, Hawley Pettibone, H. A. Kimber and C. Lee Straub will be engaged exclusively hereafter as consulting engineers. They will continue in the work followed during the past 20 years and will specialize in the design, construction and operation of power, fuel and illuminating gas plants, and their application to industrial, mining and central power station work.

AUTOMATIC TELEPHONE.—It is stated from Chicago that the Automatic Electric Company has laid off two-thirds of its forces, or about 400 men. There are plenty of contracts, but they cannot be financed owing to tight money.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was dull and stagnant, the principal feature being the renewed bearish activity by traders, resulting in a heavy tone and moderate declines. The receivership of the New York City Railway had no general effect upon the market, which is also true of the immunity granted to the Alton road in the Standard Oil rebate case. The announcement of an issue of some $30,000,000 of New York, New Haven & Hartford stock, for which the stockholders will receive rights to subscribe at 125, was far from favorable in its effect on the security in question, which showed a decline of some 15 points. The further decline in copper prices, bringing the metal down squarely to a 15-cent basis, caused, naturally, a great deal of irregularity in Amalgamated, although that issue continued to act as if it had measurably discounted the adverse conditions. The United States Steel stocks

NEW YORK.

	Sept. 24	Oct. 1		Sept. 24	Oct. 1
Allis-Chalmers Co.	8¾	7⅞	General Electric	124	123
Allis-Chalmers Co. pfd.	23¾	21½	Hudson River Tel.	—	—
Am. Dist. Tel.	20	20	Interborough Met. com.	9¼	8¼
American Locomotive	52¼	51⅝	Interborough Met. pfd.	25¼	23
Amer. Locomotive pfd	102¼	99½	Mackay Cos.	63¾	60¾
American Tel. & Cable	75	75	Mackay Cos. pfd.	63½	61
American Tel. & Tel.	105	105	Marconi Tel.	—	—
Brooklyn Rapid Transit	46¾	47	Metropolitan St. Ry.	—	36
Electric Boat	—	—	N. Y. & N. J. Tel.	—	100
Electric Boat pfd.	—	—	Western Union Tel.	75	72
Electric Vehicle	—	—	Westinghouse com.	130	120
Electric Vehicle pfd.	—	—	Westinghouse pfd.	165*	165

BOSTON.

	Sept. 24	Oct. 1		Sept. 24	Oct. 1
American Tel. & Tel.	107½	105½	Mass. Elec. Ry. pfd.	49¼	47½
Cumberland Telephone	—	—	Mexican Telephone	—	2
Edison Elec. Illum.	—	206	New England Teleo.	—	141½
General Electric	—	124¼	Western Tel. & Tel.	—	—
Mass. Elec. Ry.	—	—	West. Tel. & Tel. pfd.	—	—

PHILADELPHIA.

	Sept. 24	Oct. 1		Sept. 24	Oct. 1
American Railways	46½	46¾	Phila. Electric	7¼	7½
Elec. Co. of America	9	8¾	Phila. Rapid Transit	20¾	19
Elec. Storage Battery	46¼	44	Phila. Traction	—	86¾
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	Sept. 24	Oct. 1		Sept. 24	Oct. 1
Chicago City Ry.	150	150	National Carbon.	—	—
Chicago Edison.	140	—	National Carbon pfd.	117	—
Chicago Subway.	18¾	—	Union Traction.	—	—
Chicago Tel. Co.	—	—	Union Traction pfd.	—	—
Metropolitan Elec. com.	20*	19			

*Asked.

were subjected to more or less pressure from the bears, accompanied by vague reports about a further decline in the activity of the trade. Electric and traction stocks were ex-

tremely dull and weak, the latter in most cases suffering heavy declines. Metropolitan Street Railway closed with a net decline of 7⅞ points, and Brooklyn Rapid Transit lost 5½ points. The curb market, in the main, followed the lead of the Stock Exchange list, net losses being scored by the active issues. The closing quotations of Oct. 1 are given in the table.

ISSUES OF SECURITIES.—During the first nine months of the current year American corporations have obtained slightly over $750,000,000 of new money by the authorization and issuance of securities. Of this amount about 82 per cent went to the railroads and about 18 per cent to industrial corporations. Of it about 74 per cent was raised by means of bonds and notes and the balance through the sale of stock. The railroads issued about four and one-half times as much bonds and notes as stock, while the industrial companies issued about one and three-quarter times more stock than bonds.

Issues of less than $1,000,000 have not been taken into consideration in these figures, which do not include refunding schemes. Bonds and notes issued by industrial concerns read as follows. It will be noted that electrical and telephone companies are responsible for $35,500,000, the greater part of the total.

Bonds issued by industrials	$50,600,000
Stock issued by industrials	86,640,000
General Electric	13,000,000
Western Bell Telephone	8,000,000
Westinghouse Electric & Manufacturing	6,000,000
Tampa Gas Company	5,000,000
North American Company	5,000,000
Pacific Telephone & Telegraph	3,000,000
Atlanta Telephone & Telegraph Company	2,000,000
Bell Telephone of Missouri	2,000,000
Niagara Falls Power Company	1,500,000
Seattle Electric	1,500,000
Boomer Coal & Coke	1,100,000

The industrial stock issues appear as follows:

American Telephone & Telegraph	$22,000,000
California Gas & Electric	15,000,000
San Francisco Bonded Mortgage	10,000,000
Duquesne Light	10,000,000
Pittsburg Oil & Gas	5,000,000
Westinghouse Electric & Manufacturing	5,000,000
Canadian General Electric	3,000,000
St. Louis Car Company	3,000,000
La Belle Iron Works	2,500,000
Mexican Light & Power	2,400,000
J. G. White & Co.	1,500,000
Bell Telephone of Buffalo	1,500,000

Traction and trolley companies stand for some large amounts, such as Ohio Electric, $24,000,000; Buffalo & Lake Erie Traction, $1,000,000; Int. Rapid Transit, $10,000,000; New Orleans Railway & Light, $5,000,000; Pacific Traction Company, $2,000,000; United Railways Investment, $2,400,000; Joliet & Southern Traction, $1,700,000; Springfield & New England Traction, $1,500,000; Detroit United Railways, $2,000,000; United Railways of St. Louis, $1,200,000. Some of the large steam railroad issues have also included money for electrification.

PRICE OF CABLE SHARES.—Advices from London last week state that the general belief on the Stock Exchange that the Marconi system of wireless telegraphy is at last likely to enter into serious competition with the transatlantic cable companies has caused a depreciation in the price of shares of the latter. To meet the wireless company's competition the submarine cable companies would have to make reductions in their tariffs. Representatives of the various companies interviewed maintained that they had no fear of effective competition from the Marconi system. It is pointed out, however, that this seventeenth "cable," assuming its successful working, will be taking messages at less than half the rates charged by the submarine companies, and that therefore it will always be fully occupied. It was declared by the Marconi Company in London that under the new system, with merely two stations, the company would be able to handle as much business as eight ordinary lines. To this argument the submarine companies vouchsafed no response other than a reiteration of the declaration that no reduction of their rates would be found necessary; whereupon Mr. Marconi's London representative intimated that the rates with which the wireless service would be started were susceptible of reduction. While it is universally recognized that the cable companies are justified in their present refusal to consider the question of a reduction in rates, some criticism is heard of their cocksure attitude under the circumstances.

TELEPHONE CONSOLIDATION.—Note was made last week of the consolidation of the Bell telephone interests south of New York and northern New Jersey. The new company will operate in southern New Jersey, eastern Pennsylvania, Delaware, Maryland, District of Columbia, and northern Virginia and West Virginia, will have nearly 300,000 subscribers' stations, control property assets of $40,000,000, have yearly gross earnings of about $10,000,000, with net earnings for dividends of between $2,000,000 and $2,500,000. The consolidation, which is to be followed by others, will result in substantial economies of administration and operation, and will make possible the standardizing of telephone rates in the entire territory. At present the Chesapeake & Potomac has upward of $7,000,000 of floating debt borrowed from the parent company, which debt is to be capitalized into stock paying 6 per cent. In addition the $2,650,000 of Chesapeake & Potomac stock on which no dividends are now being paid, will be exchanged for about $1,800,000 stock of the new company, on which 6 per cent dividends will be paid. From this source the parent company through its 57 per cent ownership will derive an additional $50,000 or $60,000 annually. The new company will assume the bonded debt of the three operating companies, which is, however, relatively small, amounting to but $1,961,000. An idea of just what the consolidation comprehends may be gleaned from the following statistics of the three companies at the end of their last fiscal year, Dec. 31:

	Bell Phil.	Ches. & Pot.	Penn.	Total
Stations	164,211	70,167	46,170	280,548
Increase in 1906	39,421	17,547	8,327	65,295
Percentage increase	31.6	33.3	22	30.3
Plant investment	$24,316,938	$9,673,732	$4,564,244	$38,554,914
Capital stock	22,878,433	2,650,000	4,609,350	30,137,783
Bonds	.....	1,344,000	617,000	1,961,000
Floating debt	1,555,000	7,024,000	.....	8,579,000
Gross earnings	5,501,313	2,452,076	1,243,195	9,196,584
Balance for dividend	1,668,674	75,681	285,443	2,029,798
Gross per station	44	39	29	.....

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph's report for August and eight months compares as follows:

	1907.	1906.	1905.	1904.
August gross	$486,264	$435,298	$385,102	$333,509
Expenses	307,110	283,823	241,859	209,533
August net	$179,154	$151,475	$143,243	$124,276
Interest and taxes	37,887	33,647	24,819	22,707
August surplus	$141,267	$117,827	$118,424	$101,569
Eight months gross	$3,848,067	$3,516,114	$3,005,691	$2,607,362
Expenses	2,415,774	2,219,722	1,859,575	1,564,869
Eight months net	$1,432,293	$1,296,392	$1,146,116	$1,042,493
Interest and taxes	286,523	242,402	178,255	168,480
Eight months sur.	$1,145,770	$1,053,990	$967,861	$874,033

MONTGOMERY EARNINGS.—The report of the Montgomery (Ala.) Light & Power Company for the 12 months ended June 30, 1907, compares with the year ended Feb. 28, 1907, and the 12 months ended June 30, 1906, as follows:

	June 30, 1907.	Feb. 28, 1907.	June 30, 1906.
Gross	.....	$282,688	.....
Expenses	.....	123,714	.....
Net	$163,115	$158,974	$134,509
Charges	103,610	100,801	100,350
Surplus	*$59,505	$58,173	$24,158

The surplus after charges is equal to 2.95 per cent on the $2,000,000 capital stock outstanding.

SCRANTON ELECTRIC BONDS.—N. W. Harris & Co. are offering $1,000,000 Scranton, Pa., Electric Co.'s first and refunding mortgage 5 per cent gold bonds due July 1, 1937, optional on any interest date after July 1, 1912, at 110 and accrued interest. The company is in control of the entire electric light and power business of Scranton. It has a capitalization of $500,000 preferred stock and $2,500,000 common stock and authorized bond issue of $10,000,000. The gross earnings for the year ended July 31, 1907, were $361,165 and net earnings $134,170 and surplus $59,170.

WESTINGHOUSE EARNINGS.—The Westinghouse Electric & Manufacturing Company continues to make a favorable showing of surplus and net earnings. The total income for the five months ended August 31, aggregated $3,548,886, or at the rate of $709,775 a month, or $8,517,300 a year. The surplus for the five months aggregate $1,704,341, which was at the rate of $340,870 a month, or $4,090,440 a year. The surplus in the five months was at the rate of 16 per cent a year on the total capitalization of the company, including all classes of stock.

TRACTION MORTGAGE.—The Indianapolis & Louisville Traction Company has filed a mortgage in favor of the Colonial Trust Company, of Pittsburg, and F. F. Brooks, as trustees, to secure $400,000 mortgage and collateral trust 6 per cent five-year convertible gold notes dated July 1, 1907, and payable July 1, 1912, subject to call at any time at 102½ and interest.

GENERAL NEWS

Construction News.

MONTGOMERY, ALA.—Announcement has been made that work will soon commence on the construction of an electric railway from Geneva to Dothan. The cost of the road is estimated at $500,000. It is the intention of the promoters to eventually extend the line to Union Springs, Troy, Eufaula, Clayton and Montgomery. Richard Tullis, of Montgomery, is interested in the enterprise.

TROY, ALA.—Fox Henderson, L. M. Bashinsky and W. Chaney are interested in a project to build an electric railway from Troy to Orion, a distance of 13 miles.

FAIRBANKS, ALASKA.—Extensive improvements and additions are being made to the plant of the Tanana Electric Company which will greatly increase the capacity of the plant. A large turbo-generator set is now being installed in the power house. The company has ordered a large number of motors and other equipment from Seattle, and promises to extend its transmission lines to any section of the Tanana where operations are being conducted on a large enough scale to give promise of eventual financial returns to the company.

ALAMEDA, CAL.—At an election held Sept. 21 the proposition to issue $305,000 in bonds for public improvements was carried by a large majority. Among the improvements contemplated is included the erection of an addition to the power house of the municipal electric light plant, the installation of additional machinery and the construction of a reservoir.

LOS ANGELES, CAL.—The Edison Electric Company is planning to begin work shortly on its Kern River No. 2 power plant. This station will be located on the Kern River just above the dam and intake of its present No. 1 plant. There will be five stations in all on the river, with an aggregate output of 90,000 horse-power.

LOS ANGELES, CAL.—The Los Angeles Aqueduct Commission of the Board of Public Works is advertising for tenders for the necessary hydraulic and electrical machinery and apparatus for its proposed Cottonwood Creek hydro-electric power plant in Inyo County. The tenders call for a 750-kw, three-phase alternator to be driven by a 1400-hp tangential water wheel at 600 r. p. m. under 1200 ft. head. There will be 90 miles of 30,000-volt transmission line with cedar poles and the necessary step-up and step-down transformers, switchboard and line material. Bids must be filed before October 7.

OAKLAND, CAL.—The Oakland Gas Light & Heat Company suffered a loss by fire on Sept. 18, the damage amounting to over $100,000. The fire was caused by a guy wire falling across the main wires causing a short circuit that was carried to a steel oil tank at some distance. The oil was ignited and 6000 barrels destroyed. A 4000-kw Crocker-Wheeler alternator, recently received, was practically ruined. The transformers, overhead circuits, etc., were also considerably damaged.

OROVILLE, CAL.—Preparations are being made by the Orovillle Light & Power Company for the construction of a power plant in Humbug Valley.

REDDING, CAL.—The Northern California Power Company, which has in operation three power houses, two at Volta and one at Kilarc, and which has begun the erection of a fourth at the junction of the north and south forks of Battle Creek, is now contemplating the erection of a fifth power house on South Battle Creek. The company has acquired possession of the old George Hagen place with its large and famous springs of water. A party of surveyors is now making the preliminary surveys in the South Battle Creek country.

REDWOOD CITY, CAL.—On petition from W. J. Martin the Board of Supervisors has advertised for sale an electric light and power franchise in the First township of San Mateo County.

SAN DIEGO, CAL.—Arrangements have been made for the installation of a power plant for the electrical operation of the Los Angeles & San Diego Beach Railway. The plant of the Los Angeles-Pacific Railroad Company located at Sherman has been purchased and will be moved to San Diego. E. S. Babcock has charge of the work.

SAN FRANCISCO, CAL.—A special meeting of stockholders of the Pacific Gas & Electric Company will be held Nov 20 to consider and vote upon the proposition to increase the bonded indebtedness of the company from $10,350,000 to $14,350,000. D. H. Foote is secretary.

SAN FRANCISCO, CAL.—The Northwestern Pacific Railway is planning improvements to its North Shore Electric branch, from Sausalito to points in Marion County, involving an expenditure of $150,000. New electric generating equipment will be installed immediately at San Anselmo, and it is reported that the road will be electrically equipped to Point Reyes. At San Anselmo a sub-station will be established, to contain two 500-kw motor-generators, leaving space for four more motor-generators to provide for the extension of the electric service to Point Reyes.

SAN FRANCISCO, CAL.—Contracts have recently been closed aggregating between $800,000 and $900,000 for equipment for the Fruitvale power station of the Southern Pacific Company, which will furnish electricity for operating its tramway lines east of San Francisco. The contracts were awarded in New York, N. Y., by A. H. Babcock, electrical engineer of the company, as follows: Boilers, to the Parker Boiler Company, of Philadelphia, Pa.; H. R. Worthington & Company, for condensers and steam auxiliaries; Westinghouse Machine Company, for turbines and generators, and to the General Electric Company, for motors and other car equipment.

SAN JOSE, CAL.—The citizens are considering the question of establishing a municipal electric light plant in San Jose. At present the United Gas & Electric Company holds the contract for lighting the streets. The contract expired June 30, and Mayor H. D. Matthews has sent to the Council a message urging that body to make appropriations for a municipal plant. The Mayor calls attention to the fact that the street lighting last year cost the city over $12,000, and the cost next year promises to reach $14,000. This cost, the Mayor claims, could be materially lessened under a system of municipal ownership. An electrical engineer is to be appointed to investigate the cost of the proposed plant.

VENTURA, CAL.—F. M. Packard and J. P. Jones, of Los Angeles, have applied to the board of supervisors for a franchise to construct an electric railway from Ventura to Nordhoff.

BRECKENRIDGE, COL.—The Summit County Power Company is installing a large power plant at Dillon for the purpose of supplying electricity for mines and mills at Breckenridge, Kokomo, Frisco, Como, Argentine, Montezuma and adjacent territory. The officers of the company are: Henry L. Dougherty, chairman of board of directors; William J. Barker, president; William S. Stearns, vice-president; E. N. Stannard, secretary; Frank W. Frueauff, treasurer. The offices of the company will be in New York, N. Y., and Denver, Col.

DENVER, COL.—The Denver & South Platte Railway Company, which is to build and operate an electric railway between Denver and Littleton and other cities in Colorado, has filed a notice of a $1,000,000 mortgage with the Continental Trust Company, of Denver, the proceeds of which will be used for the completion and improvement of the road. Thomas B. Dean is president of the railway company.

TRINIDAD, COL.—The Trinidad Electric Railway Company is contemplating extensive improvements to its system, and within a year proposes to connect Cokedale, Segundo, Hastings and the interlying coal camps with Trinidad.

BRIDGEPORT, CONN.—The Union Typewriter Company has awarded the contract for the construction of its new power house in the West End.

ESSEX, CONN.—The plant and holdings of the Essex Light & Power Company have been purchased by George L. Cheney, and Mrs. William G. Seeley, of Essex; William A. Brothwell, of Chester, and G. L. Sleeper, of Deep River. The following officers have been elected: George L. Cheney, president; G. L. Sleeper, secretary and treasurer, and E. N. Frary, superintendent. The company is capitalized at $50,000, and contemplates extending its lines to Deep River, Chester and possibly to Saybrook and Westbrook.

NORWICH, CONN.—Four transformers have been received at the municipal electric light plant to be installed in the addition recently constructed, which will be used in connection with the power plant of the Uncas Power Company in Scotland, which will furnish electricity for operating the municipal electric plant as soon as it is completed.

NORWICH, CONN.—The third annual report of the Board of Gas and Electric Commissioners shows that the income from the municipal electric light plant exceeded the cost of manufacture and distribution by $36,215, and after charging off for depreciation $13,582 leaves a net profit of $22,632. The profit this year is the largest in the three years the city has had the plant by over $3,000. The total profit on gas was $7,215, while the profit on electricity was $14,463. The cost of lighting the city streets and buildings amounted during the year to $21,731, being an increase in the incandescent lighting, as the lamps are burned all night, instead of until 1 o'clock in the previous year. Because of the contract with the Uncas Power Company, it is expected that during the ensuing year the prices in electricity can be reduced. The demands on the plant for power and light are such that had the commissioners not been able to make the contract with the Uncas Power Company it would have been necessary to have greatly added to the plant.

LAUREL, DEL.—The electric light plant of the Laurel-Seaford Electric Company was destroyed by fire on Sept. 21, owing to which the towns of Bridgeville, Seaford and Delmar, in addition to Laurel, are in darkness. Charles C. Stephenson is manager.

WASHINGTON, N. C.—The managers of the Washington municipal electric plant have decided to establish a day service March 1, 1908, and will furnish electricity for power purposes, as well as lighting.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 8, to furnish at the navy yards and naval stations the following supplies: New York, N. Y., schedules 311 and 344, wireless telegraph apparatus; schedule 343, switches, etc.; schedule 351, sheet copper; League Island, Pa., schedule 349, electric and air drills, etc.; Naval Academy, Annapolis, Md., schedule 347, material for two steel towers; schedule 348, electrical supplies, sheet copper, etc.; Norfolk, Va., schedule 346, double-braided

wire, cabinet and panel board, electric chandeliers, etc., globes and reflectors, electric fittings; Pensacola, Fla., schedule 334, motors, waterproof cable, etc.; schedule 335, copper pipe. Applications for proposals should designate the schedules desired by number. E. B. Rogers, paymaster-general, U. S. N.

SOUTH JACKSONVILLE, FLA.—The new electric light plant of the East Coast Railway Company has been placed in operation, and arc lamps have been installed from the depot to the river front. The establishment of a municipal electric lighting plant in the near future is said to be under consideration.

ATLANTA, GA.—The Atlanta Telephone & Telegraph Company has applied to the State Railroad Commission for permission to issue $2,000,000. The application states that the company desires to issue $1,000,000 at once and to sell others at a later date as required. The purpose of the bond issue is to improve its property in this city and to extend its lines. C. Jerome Simmons is president of the company.

CANTON, GA.—At an election held Sept. 21 the citizens voted in favor of issuing bonds for the establishment of an electric light, water works and sewerage systems in the town.

COLUMBUS, GA.—The citizens are considering the question of establishing a municipal electric light plant and are advocating issuing bonds for $100,000 to erect the plant.

CANTON, ILL.—The People's Gas & Electric Light Company has recently contracted for a steam heating plant, and is contemplating extending its lines to St. David, five miles distant, to furnish electricity for lighting the town.

CHICAGO, ILL.—The contract between the Northwestern Elevated Railroad Company and the St. Paul Railroad contemplates all switching north of Wilson Avenue to be done by electric power as soon as the electrical equipment of the road is completed. The Northwestern Company has awarded the contract for all the overhead work in the electrical equipment of the St. Paul tracks north of Wilson Avenue to the Brennan Construction Company for $100,000.

GREENVIEW, ILL.—Frank Marbold has purchased the stock of the Middletown Mutual Telephone Company, and will install a telephone system in the east side of the county.

JOLIET, ILL.—The Joliet & Southern Traction Company has issued a mortgage to the American Trust & Savings Bank, of Chicago, as trustee, to secure an issue of $1,500,000 in bonds. The proceeds will be used chiefly to finance the construction and equipment of new lines, including those for which the Fisher Construction Company has the contract.

MANITO, ILL.—Smith & Miller, of Bloomington, have been granted a 24-year franchise to operate an electric light plant in Manito.

WAUKEGAN, ILL.—The new power stations of the North Shore Electric Company at Waukegan and Blue Island have been equipped with alternating-current electric cranes furnished by the Northern Engineering Works, of Detroit, Mich. The larger crane is equipped with an auxiliary high-speed electric hoist.

BOONVILLE, IND.—The City Council has ordered the Cumberland Telephone & Telegraph Company to remove its poles and wires from the city limits within 30 days.

CRAWFORDSVILLE, IND.—Announcement has been made that the Crawfordsville division of the Indianapolis & Northwestern Traction Company will be extended west from Crawfordsville to Danville, Ill., next spring. C. C. Reynolds is general manager of the lines in Indiana.

GARY, IND.—The Gary & Interurban Railway Company has filed amendments to its charter increasing its capital stock to $1,000,000. C. B. Murdock is secretary of the company.

GOSHEN, IND.—The Goshen Telephone Company has ordered plans for the erection of a new exchange building in which it is proposed to install a new common battery switchboard with an ultimate capacity of 3000 lines and a present equipment of 1200.

NEW CASTLE, IND.—The New Castle Telephone Company has decided to extend its lines not only in and about the city, but toll lines to Memeie, Anderson and Middletown. R. R. Faulkner is general manager.

CLINTON, IA.—The City Council is considering the question of requiring all telephone wires in the city placed underground.

IDA GROVE, IA.—The Ida Grove Electric Company is contemplating remodelling and extending its plant.

MT. PLEASANT, IA.—Messrs. Jackson & Ruggles, of Centerville, are contemplating the erection of an electric light plant in Mt. Pleasant.

NEWTON, KAN.—The Electric Light & Power Company has added to its plant a new dynamo, two switchboards and other new equipment.

ROSEDALE, KAN.—The Kansas City & Olathe Electric Railway Company is installing a 250-hp Weber gas engine in its power house at Merriman. Another engine of the same type will be installed in the plant in January.

LOUISVILLE, KY.—The Cumberland Telephone & Telegraph Company has filed an amendment to its charter increasing its capital stock from $10,000,000 to $20,000,000.

BIDDEFORD, ME.—The city of Biddeford has entered into a contract with the York Light & Power Company for lighting the streets of the city for a term of five years, beginning Oct. 1, 1907. By the terms of the contract the company agrees to operate and maintain the electric lighting system now in force, which consists of 86 arc lamps and 58 incandescent lamps at an annual rental of $10,859.81, which is the same amount as the old contract; in addition the company agrees to furnish 20 additional series enclosed alternating-current arc lamps and 25 additional series incandescent lamps free of charge, which gives the city 106 arc lamps and 83 incandescent lamps at the same cost previously paid for 86 arc lamps and 58 incandescent lamps. For each additional arc lamp furnished the price will be $82.50 per year, and for incandescent lamps $25 each per year.

SKOWHEGAN, ME.—The Skowhegan Electric Light Company is installing a 200-hp boiler in its plant, which with the boilers now installed will give its steam plant a total capacity of 600 horse-power.

WESTBROOK, ME.—Owing to the rising of the water of the Presumpscot River, caused by a heavy rainfall, the cofferdam in connection with the water-power plant to operate the new electric light station for the Westbrook Electric Light & Power Company was carried away. The damage will be very heavy, as a large part of the work done on a canal being built as a part of the improvement has been washed out.

ADAMS, MASS.—The selectmen have granted the Adams Gas & Electric Light Company permission to extend its lines to Siggsville.

MILFORD, MASS.—The electric and compressed air plant of the Webb Granite Company was destroyed by fire, caused by an explosion, Sept. 29, entailing a loss of about $8,000.

QUINCY, MASS.—The Quincy Electric Light & Power Company has recently installed a 20-hp motor at the plant of the Quincy Avenue Granite Company to operate the air compressor for the pneumatic tools, and has also installed a motor of 10 horse-power in the plant of Cook & Company for the same purpose.

TURNERS FALLS, MASS.—The Franklin Electric Light Company has completed a new schedule of prices for electricity for lighting, which gives a reduction of 33 1/3 per cent in the maximum price. The scale of prices is as follows: For 50 kw-hours per month, 12 cents per kw-hour; from 50 to 100 kw-hours, 11 cents; from 100 to 200 kw-hours, 10 cents; from 200 to 300 kw-hours, 9 cents, and for 300 kw-hours and over, 8 cents.

BAY CITY, MICH.—The City Council has instructed William H. Fitzhugh, superintendent of the municipal electric light plant, to prepare specifications for rebuilding the plant, and has also directed the comptroller to advertise for bids for its construction. It is expected that about $100,000 will be spent on the equipment.

COLDWATER, MICH.—The power house of the Branch County Poorhouse is reported to have been destroyed by fire.

MANCHESTER, MICH.—The construction of an electric light plant is under consideration, for which estimates are being made. For further information address Fred Weidmeyer.

PAW PAW, MICH.—The Falkenau Electric Construction Company, of Chicago, Ill., has been awarded the contract for installing a complete hydro-electric plant for the city of Paw Paw. The electrical equipment consists of a 150-kw and an 80-kw Allis-Chalmers water-wheel-type generators for direct connection to water wheels, two 9-kw belted exciters and a number of Allis-Chalmers motors ranging from 15 to 40 horse-power. One of the latter is to be used to drive a triplex power pump.

CALEDONIA, MINN.—An election will soon be held to vote on the proposition of issuing $6,000 in bonds, the proceeds of which will be used to improve the light and water plant.

NORTHOME, MINN.—The Village Council has granted a franchise to E. E. Bigham, of Minneapolis, to construct, maintain and operate an electric light system within the limits of the village of Northome for a period of 30 years. The ordinance granting the franchise provides that the plant shall be completed and in operation by Jan. 1, 1908.

COLLINS, MISS.—At an election held Sept. 24, the proposition to issue $5,000 in bonds for improvements to the electric light and water system was defeated.

HATTIESBURG, MISS.—The Hattiesburg Traction Company will install another large boiler to increase the capacity of the present plant to meet the requirements of the system until the new plant is ready for operation, work on which will soon commence.

UNIVERSITY, MISS.—D. S. Ross, secretary of the University of Mississippi, writes that bids will probably be received in the spring for rebuilding the power plant, which was recently burned. The cost is estimated at from $10,000 to $15,000.

JEFFERSON CITY, MO.—Contracts have been awarded by the warden and board of prison inspectors of the Missouri State penitentiary for the ventilating, heating and lighting plant for the penitentiary as follows: Boiler-house building, to John Short, Jefferson City, for $5,950; steam boilers to Heine Safety Boiler Company, St. Louis, $20,400; dynamos, to Western Electric Company, Kansas City, for $24,064; engines, to St. Louis Iron & Machine Works, St. Louis, for $20,400; motors, to Westinghouse Electric & Manufacturing Company, St. Louis, for $12,350; conduit and cable work, to F. E. Newberry & Company, St. Louis, for $10,252.

GARDINER, MONT.—The Forestry Service has appropriated $2,800 toward the construction of a telephone line from Gardiner to Cooke.

EXETER, NEB.—C. C. Smith has been granted a franchise to erect an electric light plant in this town.

YERINGTON, NEV.—The Truckee General Electric Company has completed its transmission line to this place and is now furnishing electricity to mines of the Nevada Douglas Copper Company.

ATLANTIC CITY, N. J.—The city council on Sept. 23 authorized a bond issue of $35,000, the proceeds to be used to install the electric lighting system planned for Atlantic Avenue.

JERSEY CITY, N. J.—The United Electric Company, of New Jersey, submitted the only bid to the street and water board for lighting the streets of the city. The company offers to furnish arc lamps for $97.50 per lamp per year on a yearly contract, and $75 per lamp per year on a five-year contract. The city is now paying the company $97.50 per lamp on a five-year contract, which will expire Nov. 30.

WOODBURY, N. J.—A resolution authorizing the bonding of the city for $25,000 for the erection of a municipal electric light plant has been introduced in the City Council. The city is now paying the Public Service Corporation $95 per lamp per year under a five year contract, which will expire at the end of this year. The citizens voted some time ago in favor of a municipal plant.

BROOKLYN, N. Y.—The Sutepec Electric Light & Power Company has increased its capital stock from $200,000 to $300,000.

BUFFALO, N. Y.—The Public Service Commission, Second District, has approved the application of the Crosstown Street Railway Company to construct an extension of its electric railway in Cheektowaga from the city line to the Pine Hill Road.

NEWBURGH, N. Y.—It is reported that plans for utilizing the Plattekill stream for power for a large electric plant at a cost of $500,000 are almost completed. The plan is to divert the waters of the Plattekill and the Orange Lake stream into a new channel and construct three reservoirs and erect power houses with a total capacity of 1500 horse-power. Nearly all water rights have been secured, and financing of the project is said to be assured.

FAYETTEVILLE, N. C.—The Carolina Telephone & Telegraph Company is contemplating the erection of a new building in the near future.

FAYETTEVILLE, N. C.—The county commissioners have granted permission to W. M. Morgan to erect poles and wires for the transmission and distribution of electricity from the plant of the Cape Fear Electric Power Company.

AKRON, OHIO.—The city council has passed an ordinance requiring all electric wires on Main and Howard Streets, between Federal and Jackson Streets, to be placed in underground conduits.

ASHTABULA, OHIO.—The Village Council has adopted an ordinance providing for a franchise for an electric railway from Main Street to Ashtabula Harbor by the way of Swedetown, to be awarded to the company agreeing to carry passengers at the lowest rate of fare.

CANAL DOVER, OHIO.—The question of issuing $35,000 in bonds for the purpose of erecting a municipal electric light plant will be submitted to a vote of the people at the November election. The present contract expires on Jan. 1.

DAYTON, OHIO.—The Dayton Street Railway Company has been granted a franchise from Southwest Dayton to Dayton View and Northwest Dayton. It has been announced that construction work will commence at once.

NORWOOD, OHIO.—E. A. Hafner, representing the Southern Ohio & Tri-State Telephone Company, of Cincinnati, has made application to the Village Council, for a franchise to build and operate an automatic system. The company was incorporated recently with a capital stock of $50,000.

SPRINGFIELD, OHIO.—A 400-hp rotary converter is being installed at the Medway power plant of the Ohio Electric Railway Company.

URBANA, OHIO.—It is announced that the American Automatic Telephone Company will move its plant from Rochester to Urbana after Jan. 1. It is stated with the change of location will be consummated by the absorption of the Select Telephone Manufacturing Company, of Springfield. The officers of the company will be James S. Brailey, Jr., of Toledo, president; J. W. Lattig, of Rochester, N. Y., vice-president and general manager; B. J. Williams, of Rochester, N. Y., secretary and treasurer, and S. B. Grove, of Toledo, assistant treasurer.

ENID, OKLA.—R. G. Webber and A. B. Hulit, of Kansas City, have made application to the City Council for a 20-year franchise for an electric light plant. The company promises to erect a plant costing between $75,000 and $100,000, and will commence the construction immediately upon the granting of the franchise.

OKLAHOMA CITY, OKLA.—The Oklahoma City Street Railway Company has filed amendments to its articles of incorporation providing for extensions to Guthrie, south to Norman, and west to Yukon, a total distance of 125 miles. The capital stock of the company is $3,000,000, and the incorporators are John W. Shartel, Anton Classen, George H. Brauer, Charles Edward, W. F. Cooke and J. M. Owens.

GOLD HILL, ORE.—The Gold Hill Canal Company has purchased the Condor Water Power Company of Gold Ray and has made an initial payment of $350,000. This insures the completion of the Gold Hill Canal, as this company now controls the electrical situation of Rogue River. Headquarters of the company will remain in Gold Hill.

INDEPENDENCE, ORE.—The City Council has unanimously passed the water and light ordinance by which the Willamette Valley Company agrees to install 12 or more arc lamps of 1200 cp. each and furnish current for same; ten 16-cp. incandescent lamps in the city hall and jail buildings and five more fire hydrants.

PORTLAND, ORE.—The Mount Hood Railway and Power Company has begun work on its $2,000,000 power plant on the Sandy and Bull Run rivers. The company is to operate into Portland over a private right-of-way.

BENTLEYVILLE, PA.—Application has been made for a charter for the Finleyville Southern Street Railway, which plans to construct an electric railway from Finleyville to Bentleyville, a distance of 14 miles. The incorporators are M. J. Hayden, T. M. Hayden, H. B. Hayden and S. C. Wilson.

DRAVOSBURG, PA.—The Council has passed an ordinance granting a franchise to the Dravosburg Heights Street Railway Company over the veto of Burgess Simpson.

HANOVER, PA.—The Hanover & McSherrystown Street Railway Company has secured franchises from the McSherrystown Council for the extension of its line through the town, and proposes to extend its line to Robert's Mill and Littlestown, a distance of about five miles, work on which will commence in a few weeks.

LANCASTER, PA.—The Conestoga Traction Company has purchased a site on which it will erect a new car barn and power house to take the place of the one on North Queen Street. It is expected that work will commence on the construction of the new plant within 30 days.

PHILADELPHIA, PA.—Bids will be received by George R. Stearns, director department of public works, until Oct. 22, for equipment and materials for improvement, extension and filtration of the water supply as follows: Contract No. 109, electric equipment for Torresdale filters; contract No. 126, pumping engines for Lardner's Point pumping station; contract No. 127, boilers, Torresdale pumping station; contract No. 128, centrifugal pumping engine for Torresdale pumping station; contract No. 134, magnesia covering and painting at Lardner's Point pumping station. Specifications, drawings and blank forms upon which bids must be made can be obtained from the chief engineer of the bureau of filtration, room 712, City Hall, to whom all communications should be addressed.

PHILADELPHIA, PA.—Arrangements have been completed by which the Bell Telephone Company of Philadelphia and the Pennsylvania Telephone Company, the Chesapeake & Potomac Telephone Company and all licenses of the Commercial Bell Telephone Company now occupying contiguous territory in South New Jersey, Eastern Pennsylvania, Delaware, Maryland, Northern Virginia and West Virginia are merged into one company. The companies named are operating over 300,000 telephones and are in no way competitors. The object of the consolidation is to secure better service, greater economy and efficiency in the operating and management of the various departments and to finance extensions and enlargements. The authorized capital of the combined companies will be $60,000,000; this will retire all the old stock, discharge floating indebtedness of all companies and provide for several years' growth.

PITTSBURG, PA.—The corporation committee of the council has approved the ordinance granting a franchise to the Diamond Light & Power Company after adopting some amendments. The compensation to the city was fixed at 1½ per cent of the gross receipts, instead of 5 per cent of the net receipts; the city auditors are given the right to examine the books of the company, and the company must furnish arc lamps to the city at a price not exceeding $70 per lamp per year.

WASHINGTON, PA.—Negotiations have been closed by the State Mutual Telephone & Telegraph Company whereby it comes into possession of the property of the Federal Telephone Company, operating in Canonsburg, South Canonsburg and Houston.

WINDBER, PA.—It is reported that the Berwind-White Coal Mining Company is contemplating the construction of an electric railway to connect Central Windber with the various mines of the company.

PROVIDENCE, R. I.—Announcement has been made by the Narragansett Electric Lighting Company of its intention to construct a waterproof conduit from a point near South Street to the easterly shore of the Providence River. The dimensions of the tunnel contemplated are about 8 ft. in diameter and 400 ft. long, the cost of which is estimated at $40,000.

ABERDEEN, S. D.—The Broton-Ferney Telephone Company, it is said, has accepted the conditions of the city council for building a telephone into the city.

LAWRENCEBURG, TENN.—W. J. Neely, of Columbia, has secured the contract for the construction of the concrete dam for the municipal electric light plant, and Howard Neely, of Chattanooga, the contract for the tunnel. The turbines and dynamo will be purchased by W. G. Kirkpatrick, of Jackson, Miss., the engineer in charge of the plant.

MEMPHIS, TENN.—The machinery in the new plant of the Conley Frog & Switch Company, which has just been completed, will be operated by electricity. J. E. Conley is president of the company.

NEWPORT, TENN.—C. G. Holland, mayor, writes that the citizens on Sept. 21 voted to issue $50,000 in bonds, the proceeds to be used for the construction of an electric light plant, water works and a sewerage system.

EL PASO, TEX.—The Bell Telephone Company has decided to make improvements to its system in this city, which will involve an expenditure of about $100,000.

HOUSTON, TEX.—McMeen & Miller, of Chicago, Ill., have been awarded the contract to install the new automatic telephone in the city.

McKINNEY, TEX.—A committee has been appointed by the City Council to investigate the question of issuing additional bonds for the purpose of improving the electric lighting and water works systems.

PROCTOR, VT.—We are informed that the Vermont Marble Company has decided not to install a plant at Pittsford this season, at least, and may not do anything with it another year, as it is a very expensive proposition to develop, and it is questioned whether it will be a paying investment.

AMHERST, VA.—It is reported that a company will soon be organized for the purpose of installing an electric lighting plant in Amherst.

BOYDTON, VA.—R. W. Lassiter, of Oxford, N. C., has been in town recently negotiating with parties owning land on the Roanoke River, with a view of securing water rights on the river for the purpose of establishing an electric light plant at Eagle Point Falls.

BRISTOL, VA.-TENN.—John H. Gose, city clerk, writes that J. D. Mitchell, Harry Roberts and Theodore Swann, all of Bristol, have secured a franchise to erect an electric power plant in Bristol.

WAYNESBORO, VA.—The electric light plant and pumping station were completely destroyed by fire Sept. 25, which leaves the town without water and light. The plants were owned by W. A. Rife.

BELLINGHAM, WASH.—Albert A. Haug is interested in a project to build an electric railway to connect Bellingham with the Mt. Baker mining district.

CASTLE ROCK, WASH.—The St. Helens (Ore.) Mill & Power Company is preparing to install a large power plant on the Tontle River with a head of 860 feet, which will generate ultimately approximately 20,000 horse-power. The water flowing from Spirit Lake will be utilized.

CHEHALIS, WASH.—C. L. MacKenzie, of Colfax, and Edward Riggs, of Portland, Ore., have closed negotiations with Harry West for the purchase of the electric light plant in this city. Mr. West has a lease on the city's business, which will not expire for 13 years. The plant is located on Coal Creek, east of the city, at the mouth of a coal mine, where there is an ample supply of fuel within a few hundred feet of the plant.

RENTON, WASH.—The City Council on Sept. 18 voted to take preliminary steps toward the installation of a municipal electric lighting plant to cost about $25,000. A committee was appointed to investigate and report plans to the Council. The Snoqualmie Light & Power Company is now lighting the city.

SEATTLE, WASH.—The Seattle Electric Company has closed a contract with the Washington Coal Briquette Company which will result in the erection of a factory at Renton for the manufacture of briquettes from waste coal. The site has been secured, and plant will have capacity of 125 tons a day.

TACOMA, WASH.—L. H. Pearson, clerk for Commissioner of Public Works, writes that the proposition in regard to the proposed municipal power plant is at present in the hands of a committee of the City Council, with a view to purchasing the water rights and site on the Upper Nisqually River.

TOPPENISH, WASH.—The City Council has granted a franchise to E. F. Bohannon, of Toppenish, to construct and operate an electric lighting plant.

WHEELING, W. VA.—Senator S. B. Elkins, Col. Richard O. Kerns and Henry Gasaway Davis, of New York, N. Y., have secured a charter for an electric railway through the counties of Taylor, Barbour and Randolph in West Virginia, to be connected with the Morgantown, Fairmont and Mannington line, which is to be extended to Wheeling and then run direct to Pittsburg. The name of the new company is the Elkins Light & Power Company, and the main office will be at Elkins.

OSHKOSH, WIS.—The Winnebago Traction Company, which some time ago was placed into the hands of a receiver, has taken steps for reorganization. This plan contemplates improvements in Oshkosh and vicinity amounting to $300,000. It is proposed to spend $100,000 on the Oshkosh plant and for cars, and to build an extension to Berlin, on the Oshkosh-Omro line, at a cost of $200,000.

CHEYENNE, WYO.—The city council has granted a franchise to W. J. Parker, president of the Northern Colorado Power Company, for a street railway system, which is to be completed within six months.

CALGARY, ALB.—The municipal electric light plant at Calgary, after paying all interest and expenses, has a surplus for the first seven months of the year of $9,469.

EDMONTON, ALB.—P. Cronin, representing George Balfour, an English civil engineer, has made a proposition to the City Council to purchase the electric street railway system now being built by the city. Address Mayor May.

VANCOUVER, B. C.—The British Columbia Electric Street Railroad Company has arranged for the expenditure of $1,000,000 during 1908. An additional 10,000 horse-power will be developed at Lake Buntzen; $75,000 will be spent for equipment of the Eburne-New Westminster line and a considerable amount will be expended on the Chilliwack line. For particulars address R. H. Sperling, general superintendent.

BRANDON, MAN.—The Brandon Electric Light Company is applying to the Manitoba Legislature for power to increase its capital from $125,000 to $400,000.

BRANDON, MAN.—Tenders will be called for at once for the construction of the conduits and central exchange to be built here in connection with the Manitoba government's telephone system. Address Orrin F. French, Winnipeg, Man.

WINNIPEG, MAN.—A by-law will be voted on by the taxpayers at the next civic election to authorize the expenditure of $200,000 for the building of conduits on the principal streets. Address F. E. Cambridge, city electrician.

EAST TORONTO, ONT.—Contracts have been awarded by the corporation of East Toronto for building the power plant and furnishing its equipment, which consists of 150-kw, 2200-volt, three-phase, 60-cycle generator of the revolving field type made by the Allis-Chalmers-Bullock Company, Montreal. The exciter is a 15-kw, 125-volt machine. The plant will also furnish electricity for operating the water works system. John P. Galt, of Toronto, is consulting engineer.

KENORA, ONT.—A company is being formed here for the purpose of building an electric railway from this town to Keewatin and from thence along the Winnipeg River to connect with the Grand Trunk Pacific Railroad. A charter is now being applied for.

OTTAWA, ONT.—The W. C. Edwards Company is planning to operate its new factories by electricity, which will be developed partly by steam and partly by water power from the Rideau River.

ST. CATHERINES, ONT.—The Falls Power Company has applied to the city council for a franchise to erect poles and wires for the distribution of electricity for lighting and power purposes in the city. The request is made in view of the fact that the Stark Company will not be able to begin the lighting of the city by Nov. 1, in accordance with the extension of time granted in May, and the Falls Company is willing to take over the franchise and supply arc lamps at $39.50 each for a period of years. The Lincoln Electric Light & Power Company is now lighting the city at the price of $72.50 per arc lamp, upon a temporary extension of the old contract.

PUEBLA, MEX.—Announcement has been made that the control of the Puebla Tramway, Light & Power Company has been purchased by a syndicate in London, Eng., of which Sir Westman Pearson is head. The transaction, it is said, involves the consolidation of the Anglo-Mexican Electric Company, Ltd., with the Puebla.

Company Elections.

CŒUR D'ALENE, IDAHO.—At a meeting of the stockholders of the Idaho Water & Electric Power Company, held Sept. 10, the following officers were elected: J. L. McClear, president; P. J. Scanlon, vice-president; Maude Thornton, secretary; Charles G. Dawes, treasurer. This company was organized recently for the purpose of developing the power of the St. Joe River, by the construction of many dams, to generate power to operate the trains of the Chicago, Milwaukee & St. Paul Railway across the mountains.

BENTON, ILL.—At a meeting of the stockholders of the Tri-County Telephone Company held recently the following directors were elected: O. S. Martel, W. S. Means, Felix Dillon, J. E. Dixon, J. J. Pierce and George W. Young.

New Industrial Companies.

THE W. F. BOSSERT MANUFACTURING COMPANY, of Utica, N. Y., has filed articles of incorporation with a capital of $50,000. The directors are William F. Bossert, Hiram C. Williams and Charles G. Bennett, all of Utica. The company proposes to manufacture railway signals.

THE IMPROVED ELECTRIC MOLDING COMPANY, of New York, N. Y., has been chartered with a capital stock of $500, and the following directors: Adolph Muller, John F. Sherlock, of New York City, and Chester Martin, of Brooklyn.

THE INTERNATIONAL ENGINEERING COMPANY, of Fort Wayne, Ind., has filed articles of incorporation with the Secretary of State, with a capital stock of $200,000. The object of the corporation is the manufacture and sale of machinery and mechanical and electrical appliances. The directors are: George H. Loesch, Charles H. Doebler and F. L. Jones.

THE INTERNATIONAL HELP-A-PHONE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture telephone instruments. The directors are Charles G. Van Gilder, Morristown, N. J.; George H. Opdyke, New York; Thomas Lincoln, Brooklyn.

THE LENSED ELECTRIC SHADE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The directors are Charles Wheeler and Joseph B. Hall, of Chicago, Ill.; Joseph O. Stillson, of Indianapolis, Ind.; D. M. Gilbert, of New York, N. Y.

THE LOOMIS-PETTIBONE COMPANY, of Hartford, Conn., has been incorporated with a capital stock of $100,000 by Burdett Loomis, of West Hartford; Hawley Pettibone, of New Rochelle, N. Y., and Harrison P. Freeman, Jr., of Hartford. The company proposes to manufacture mechanical apparatus and railroad equipment and to construct and operate railways and telegraph lines.

THE MERIDEN LIGHT & EQUIPMENT COMPANY, of Meriden, Conn., has filed a certificate of organization with a capital stock of $25,000 for the purpose of manufacturing and dealing in electrical supplies. The incorporators are Elizabeth Sanderson, Edith S. Childs and Walter Sanderson, all of Waterbury, Conn.

THE NEW YORK LINK BELT CHAIN COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000. The directors are Alfred Beinhauer, Edward J. West, New York, and Samuel F. Clouser, Brooklyn.

New Incorporations.

LOS ANGELES, CAL.—The Tejunga Power & Water Company has been organized with a capital stock of $250,000 to develop the water power of Little Tejunga Canyon, and to distribute it for irrigation purposes. C. F. Hunter, Johnston Jones and Dr. J. W. Trueworthy are interested in the project.

NAPA, CAL.—Articles of incorporation have been filed for the Napa Valley Electric Company. The capital stock of the company is placed at $200,000. Percy S. King is one of the directors.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Northern Electric Railway Company with a capital stock of $25,000,000. This company has been formed to acquire the Northern Electric Company and the Shasta Southern, besides constructing new roads to the northern part of the state. The petition states that it proposes to build a railway from Chico to Redding, a distance of 76 miles; from Sacramento to Folsom, 26 miles; from Sacramento to Hamilton, via Woodlands, with a branch to Colusa, 108 miles, and from Sacramento to Yuba City, 28 miles. The directors are Alan W. Maginnis, Curtis Hillyer, Francis C. Van Deinse, Martin L. Washburn, Harry C. Mack, Charles Elsey and R. Augustus.

DENVER, COL.—The Eaton Electric Company has been incorporated with a capital stock of $35,000 by W. J. Farr and others.

CHAMPAIGN, ILL.—Articles of incorporation have been filed for the Danville & Southern Railway Company with a capital stock of $10,000 by W. H. Carnahan, B. E. Bramble and others. It is proposed to construct an interurban railway from Danville to Georgetown.

HINSDALE, ILL.—The Hinsdale Electric Company has been incorporated with a capital stock of $2,500 by Arthur Marrow and others.

CLAY CITY, IND.—The Clay City Lighting Company has filed articles of incorporation with the Secretary of State. The capital stock is $10,000. The company was organized to build an electric light and power plant in Clay City. J. M. Long, H. R. Vandivier, B. M. and W. H. Guirl are the incorporators.

EVANSVILLE, IND.—The Evansville, Pittsburg & Vincennes Railroad Company has been chartered with a capital stock of $10,000 by F. W. Cook, T. N. Honeywell, J. M. Fenke, L. J. Herman, H. E. Meyer and others. The company proposes to construct an electric railway from Evansville to Petersburg and intermediate towns.

LEBANON, IND.—The Citizens' Electric Light & Power Company has been incorporated to operate an electric light plant here. The capital stock is $25,000. Richard A. Edwards, George R. Chamberlain and M. A. Edwards are the directors.

TULSA, I. T.—The Tulsa Electric Light Company has been incorporated, with a capital of $15,000, by R. D. Campbell and D. M. Martindale, of Tulsa, and H. F. Burt, of Oklahoma City, Okla.

PELLA, IA.—Articles of incorporation have been filed for the Waterloo Southwestern Railway Company with the secretary of state for the purpose of constructing and operating an electric railway by either steam or electricity from Waterloo via Pella to Charlton, a distance of about 130 miles. The capital stock of the company is placed at $150,000, and the directors are E. A. Harris, P. H. Van Gorp, P. H. Bousquet, U. L. Hendrichs, A. N. Kuyper and others, all of Pella and vicinity.

PORTLAND, ME.—The Bromfield Electric Company has been organized for the purpose of generating electricity or gas for light, heat and power purposes. The company is capitalized at $500,000 and the incorporators are Charles M. Drummond, of Portland, president, and Wadleugh B. Drummond, treasurer.

PORTLAND, ME.—The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company has been organized in Portland, Me., for the purpose of constructing and operating an electric railway in Minnesota and Iowa. The capital stock of the company is $25,000,000, and the officers are Eben Winthrop Freeman, of Portland, president, and M. H. Boutelle, of Minneapolis, Minn., secretary.

TRAVERSE CITY, MICH.—Articles of association have been filed for the Traverse City Street Railway Company with a capital stock of $25,000. The company will operate a street railway in the city.

TRAVERSE CITY, MICH.—The Grand Traverse Railway Company has filed articles of association with a capital stock of $450,000. The company proposes to build an electric railway from Traverse City to Elk Rapids and thence to Charlevoix.

WINONA, MINN.—Articles of incorporation have been filed for the Homer Rural Telephone Company with a capital stock of $5,000 by Lloyd Barber, O. S. Bundy and J. H. Johnson.

HELENA, MONT.—The Capital City Power Company, of New Jersey, has been incorporated with a capital stock of $2,000,000 by B. R. Higgins, S. Hartman and H. S. Leonard, of New Jersey. A. P. Thatcher, of Helena, is named as state agent. This is the corporation which has been formed for the purpose of building the third dam across the Missouri, near Helena.

LEICESTER, N. C.—The Leicester Telephone Company has been incorporated with a capital stock of $5,000 by T. F. Reynolds and others.

STATESVILLE, N. C.—The Goodwill Telephone Company has been incorporated with a capital stock of $2,000 by George M. Teague and others.

Legal.

ELECTRIC LIGHT WIRES ON TELEPHONE POLES.—Judge Heaton, of the Superior Court, has decided against the city in the suit to restrain the Home Telephone Company from interfering with the city's purpose to use the top cross-arms of the telephone company's poles on which to string electric light wires. The city's plan for the building of a municipal light plant included use of the company's poles for high tension wires, under the clause in the franchise which purports to give the city the right to string wires for police or fire alarm purposes. The court held that the franchise reserved no rights to the city to string wires of a dangerous and disturbing character on such poles for the conveyances of energy for lighting. The decision will greatly increase the cost of the city's plant, and will delay the completion of the work.

THE AMERICAN TRUST & SAVINGS BANK COMPANY and Frank H. Jones, both of Chicago, have filed foreclosure proceedings in the United States Circuit Court at Cincinnati against the People's Gas & Electric Company, of Xenia, Ohio. The Western Gas & Investment Company, with headquarters in Chicago, is made a party defendant. The petition charges that the company is wholly insolvent and unable to pay its debts and that the plant is shut down. Last March, in a suit brought by Evelyn Bird, the Union Savings Bank & Trust Company, of Cincinnati, was appointed receiver by the United States Circuit Court and is still acting in that capacity. Notwithstanding this action, the American Trust & Savings Bank Company asks for the appointment of a receiver. The two suits are very similar in their nature, with the exception that the last one asks for a foreclosure of its mortgage and that the plant be sold as a going concern. Its being closed down, it is averred, will result in a damage to the business that the plant might secure.

LIABILITY OF ELECTRIC COMPANY FOR INJURIES TO LINEMAN UNDER EMPLOYER'S LIABILITY ACT.—In a recent action for damages the plaintiff was an employee of defendant as one of a gang trimming trees so as to admit the stringing of defendant's electric wires. The gang's foreman pointed out a tree for trimming, and plaintiff, with another, climbed the same, attached a rope to a limb, and then cast it over a crotch of the tree above the limb, so that the loose end of the rope dropped to the ground. They then sawed off this limb, which fell on a lower limb. The lower limb was then sawed off, but when it fell the foreman held the rope taut, so that the limb to which it was attached did not fall with the lower limb, but remained suspended in the air and swung it toward plaintiff, who, in attempting to avoid it, fell to the ground. It was held that the foreman in holding the rope was not engaged in an act of superintendence, within the employer's liability act, making an employer liable for injuries to an employee resulting from the negligence of any person in the service of the employer entrusted with and exercising superintendence. Lowery vs. Huntington Light & Power Company, New York Supreme Court, Appellate Division, 105 N. Y. Supp. 852.

DE FOREST LITIGATION.—Suit asking for the rescinding of contract, for the recovery of wireless patents and for an injunction has been instituted in the Supreme Court of the District of Columbia by Lee De Forest against Benjamin F. Cole. The petitioner sets forth that he is the inventor of wireless telephony and wireless telegraphy discoveries, apparatus and methods covered by twelve United States patents, and that there are eight patents applied for, including one for aerophones. These patents are listed as beginning with Dec. 12, 1905. It is alleged that De Forest and Cole on Nov. 9, 1906, entered an agreement that De Forest give his exclusive time to the development of wireless telephony for a certain time and that he should receive from Cole a salary of $250 a month. De Forest was to apply for patents and to assign them to Cole, it appears, while Cole was to furnish money to secure patents in England, France, Russia, Denmark and Sweden and to pay other necessary expenses. The whole amount to be paid was not to exceed $8,000 a month for three months. De Forest was to adjust all outstanding claims and contentions between himself and Abraham White and the American De Forest Wireless Telegraph Company, so that De Forest should be able to deliver a clear title to absolute ownership and possession of practically all outstanding patents granted him, and that Cole agreed to incorporate a company with a capital of $100,000, to which was to be assigned all of the De Forest patents. According to the alleged agreement 25 per cent of the stock was to go to De Forest, and the other 75 per cent to Cole and his associates. It is stated that Cole agreed to pay in $60,000 to the company before its incorporation. It is set forth that on Feb. 7, 1907, De Forest filed with the Patent Office a written conveyance of his patents to Cole; that De Forest has carried out his share of the agreement; that he succeeded in obtaining a final adjustment of his contentions with Abraham White and the American De Forest Wireless Telephone Company; that De Forest has incurred an expense of $6,000 under the agreement and that Cole has failed to advance more than $1,000 under the agreement. De Forest tells the court he believes the defendant is about to transfer the patents to third parties and he asks for a restraining order to prevent this. The prayers also ask for orders rescinding the agreement and revoking the assignment of the patents to Cole.

Educational.

FALL RIVER TEXTILE SCHOOL has a new course in steam and electrical engineering as applied to the textile industries. Mr. James H.

Jack has been appointed instructor in this course for both day and evening classes.

INSTRUCTION IN TURBINES.—The first public school course in the practical handling of a turbine engine will be offered this winter as part of the industrial training at the new Stuyvesant High School, in East Fifteenth Street, New York City. A 250-hp turbine has just been erected in the school building, to serve a double purpose of generating current and for laboratory work by the students. In the same room is a 350-hp tandem compound engine of the latest type of cylinder-driven machines. This generates its share of the 400 kw of power needed to drive the shop machinery and light the buildings. The students, therefore, will have an opportunity to test and compare the working of the two latest types of generators. The question of instruction in operating steam engines of various types is being investigated by the National Society for the Promotion of Industrial Education for discussion at its annual meeting in Chicago on Dec. 5. Thus far, however, the Stuyvesant High School is the only municipal trade school found in which turbine instruction is contemplated.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Some changes in the electrical engineering course are proposed after a consultation with a special advisory committee of engineers which was appointed by the corporation over a year ago to confer with the teachers of the department. This committee consists of Prof. Elihu Thomson, Mr. C. L. Edgar, Mr. H. V. Hayes, Mr. Chas. F. Scott and Mr. L. A. Ferguson. There is also a visiting committee consisting of Prof. Thomson, Mr. Francis Blake, Mr. F. P. Fish, Mr. Chas. A. Stone, Prof. Percival Lowell and Mr. Chas. T. Main. In the new arrangement the student is expected to take one foreign language for a year and a half instead of two languages each for a year. The study of applied mechanics will be started at the opening of the second term of the second year. Another feature is a series of six lectures in the second year by the professor of electrical engineering. These will relate to power and its applications, power in industrial life and in its influence on civilization. Effort will be made to overcome the tendency of students to slight work which is not distinctively electrical in character. The work in hydraulics, steam engineering and the design of stationary structures will be improved, and thesis work will probably be begun at the beginning of the senior year. Some general studies will probably be included in the senior year for the breadth which they give.

Obituary.

MR. JAMES LANG, founder of the J. Lang Electric Company, Chicago, died Sept. 10 at the age of 84. Mr. Lang founded the company which bears his name about 25 years ago, but disposed of his interest and retired from business about five years ago.

Personal.

PERCY H. THOMAS.

MR. PERCY H. THOMAS left the Westinghouse interests on Oct. 1 to join with N. J. Neall, consulting engineer of Boston, to form the firm of Thomas & Neall, electrical engineers, with offices in New York and Boston. The firm intends to do general consulting work in electrical engineering, giving special attention to high-tension transmission design, to the investigation of the difficulties in operation on high-voltage plants, lightning protection and extra high-tension practice. While connected with the Westinghouse Electric & Manufacturing Company, Mr. Thomas and Mr. Neall did a large amount of investigation work on high-tension problems, both experimentally and in commercial systems. Mr. Thomas graduated from the Massachusetts Institute of Technology and entered the Westinghouse employ as a "student." His early work was on insulation of apparatus and on transformers, followed by a residence in Brazil in 1896-7 in connection with one of the early transmission plants. Later he spent some years in the investigation of static disturbances and lightning, with special reference to the protection of commercial systems. More recently, as chief electrician of the Cooper Hewitt Electric Company, he carried on the practical development of its well-known mercury vapor apparatus, in which and other fields he has made several inventions. Mr. Thomas is a man of great public spirit and has for some time been actively interested in the American Institute of Electrical Engineers, before which he has read a number of papers. Last year he was chairman of the committee on increase of membership and this season he is chairman of the meeting and papers committee. Mr. Neall, who is also a graduate of the Massachusetts Institute of Technology, has made a specialty of high-tension work. He has been practicing his profession successfully in Boston, where he opened his office in the spring of 1906.

MR. J. T. BURKE, connected with the Southern Pacific Company, has been elected president of the Peninsular Electric Railway Company, of San Jose, Cal.

DR. W. M. HABIRSHAW, of insulated wire and cable fame, has recently returned to New York, after a long sojourn on the other side of the Atlantic in search of health.

MR. J. T. DAY, chief electrician of the New Hampshire Electric Railways, at Haverhill, Mass., has resigned to accept a position as chief electrician with the Malden Electric Company, of Malden, Mass.

MR. FRANK STOUT, who for the past nine years has been associated with the I. P. Frink concern, now occupies a position of similar character with the Bryant Electric Company, and will represent it in the territory east of Pittsburg and Buffalo.

MR. ARTHUR E. PAIGE, patent attorney, announced that on Oct. 1 his offices were removed from the Land Title Building, Philadelphia, to 714 Walnut Street, where he has maintained an office and laboratory for more than 21 years.

MR. ALBERT CARR has resigned his position as chief engineer of the United Railroads of San Francisco to take the position of superintendent of construction on the water power developments of the Central Colorado Power Company, with headquarters at Colorado Springs.

MR. CARL D. MURALT, who was recently elected an additional professor of electrical engineering at the University of Michigan, has been granted a month's leave of absence to act as consulting engineer for the Austrian Government in the electrical equipping of the Alberg tunnel.

MR. J. E. HAM, who has had a very long connection in the East with the insulated wire industry and was more recently with the Hazard Manufacturing Company, has been appointed representative of the Waterbury Company for the introduction of its insulated wires and cables. His headquarters will be the Waterbury branch office at 108 La Salle Street (Stock Exchange Building), Chicago.

MR. J. E. FRIES, who has been connected for some time past with the Allis-Chalmers Company at Milwaukee, has joined the Power Improvement Company of that city, a comparatively young concern engaged in the consulting field of engineering. Among the industries employing the power company is the Schlitz Brewing Company, which will build a large central station at Lake Michigan and transmit electrical energy to the brewery at Milwaukee and the New Majestic Theatre. It is proposed by the company also to take up electric railway work. This is a branch to which Mr. Fries devoted much of his time while with the Allis-Chalmers interests. Mr. Fries is a Swedish engineer of high technical training and wide experience in the electrical field.

Trade Publications.

CIRCUIT BREAKERS.—In its bulletin No. 4516, the General Electric Company illustrates and describes direct-current circuit breakers especially designed for electric railway equipments.

ARC LAMPS.—Enclosed alternating-current, constant-potential arc lamps for 104 volts and 6 amperes are well illustrated and discussed in detail in Bulletin No. 1095 of the Fort Wayne Electric Works, Fort Wayne, Ind.

AIR COMPRESSORS.—Bulletin No. 1513 of the Allis-Chalmers Company, Milwaukee, Wis., is devoted to Christensen portable air compressors, which are designed for 11, 16, 20 or 25 cu. ft. of free air per minute, for driving pneumatic tools.

H. W. JOHNS-MANVILLE COMPANY has issued a small, neat brochure with gray cover printed in red and black, devoted to the Morris metallic packing for which it is sole selling agent. This packing is standard for Corliss valve stems and all piston rods, steam turbines, hydraulic air, gas, ammonia and vacuum uses.

KEYSTONE TRAVELER.—The September number of the Keystone Traveler, which is published by the Electric Service Supplies Company, is full of bright sayings about the many articles handled by this company. "Supplies for every electric service" is what the company carries in stock. The more serious reading matter is lightened and brightened by an occasional funny story.

FORT WAYNE GENERATORS AND MOTORS.—Two recent bulletins of the Fort Wayne Electrical Works relate respectively to direct current belted generators for lighting and power and small direct current motors. In both cases every detail of the apparatus is illustrated by well-executed cuts, and in the motor catalogue are included illustrations showing the application of the motor described to driving a radial drill and a pump.

PRINGLE CATALOGUE.—The Pringle Electrical Manufacturing Company, of 1906-8 North Sixth Street, Philadelphia, has just issued a new edition of its catalogue. The catalogue is very complete, giving illustrations, descriptions and price lists of goods of Pringle manufacture, showing a large variety of high-grade switches, panel boards, iron and wood cabinets, switchboards and accessories, wall and floor receptacles and other specialties. Copies of this new catalogue are now available to the trade.

LIGHTING AND POWER SUPPLIES.—Catalogue No. 11 of the Commercial Electrical Supply Company, of St. Louis, Mo., is a quarto

cloth-bound volume of 362 pages entirely devoted to lighting and power supplies. This supplements the other catalogues of the same house on Telegraph Apparatus and Supplies, Street Railway and Mining Supplies and "New Idea" Fixtures. The material is listed in such a way that, so far as possible, all articles having relation to each other are grouped together. The general index is supplied with a marginal thumb index.

APPLE IGNITION OUTFIT.—The Dayton Electrical Manufacturing Company, of Dayton, Ohio, has just issued Bulletin No. 7, describing its 8-s switchboard gas engine ignition outfit. The outfit consists of the 8-s switchboard and two storage batteries, and is for use with stationary gas engines, which are used to drive direct current lighting or power dynamos. The switchboard provides for charging two storage batteries alternately from the lighting or power dynamo. This bulletin describes and illustrates fully this outfit and will be sent upon request to all who are interested.

HOLOPHANE.—The sales and engineering departments of the Holophane Company, 227 Fulton Street, New York, have issued the first number of a monthly publication entitled "Holophane," devoted to the system of illumination with which this name is associated. A brief history is given of the work of the Greek engineer, Psaroudaki, and Prof. Blondel, of Paris, in producing a globe of clear glass, with prisms upon its surface so disposed as to break up the glare of the intense light with very little loss by absorption. The monthly will endeavor to give those interested in the science of illumination a more exact appreciation of the practical application of that science.

WELDED PIPE.—The National Tube Company, Pittsburg, Pa., has issued an illustrated book by Mr. F. N. Speller, describing in detail the manufacture of welded pipe from ore to finished product. Mr. Speller says: "In writing and illustrating this work I have endeavored to treat the subject in a popular style as far as possible, the object being to familiarize all users of pipe with the properties of the materials involved and their treatment in the course of manufacture. This is a branch of the iron and steel industry the elements of which have been little understood by engineers, architects and consumers in general. It has been our object in this short treatise to meet this need, believing that the result will be beneficial to all concerned. Any of your readers who are directly interested may obtain copies by writing to the nearest office of the company, either in New York, Pittsburg, Chicago, St. Louis or San Francisco."

Business Notes.

JNO. H. COWLES & CO., 544 Fifth Street, Louisville, Ky., have succeeded to the business of Haight & Co., brass founders, silver, nickel and copper platers, etc., and will develop along the lines followed during the past 30 years.

FRINK REFLECTORS.—Frink's special patent window reflector, made by I. P. Frink, 551 Pearl Street, New York City, has been installed in all the newest of the large stores opened recently in this vicinity, viz., Greenhut & Company, Oppenheim, Collins & Company, John Forsythe, Sheppard Knapp & Company and The Berlin, Brooklyn, N. Y.

BLAKE SIGNAL & MANUFACTURING COMPANY, Boston, Mass., will be represented at the American Street & Interurban Railway Convention, at Atlantic City, Oct. 14 to 18, inclusive, by E. J. Burke, C. C. Blake and George S. Hastings. It will have a complete working exhibit of standard signal apparatus, together with a trained and competent train dispatcher, various types of railway telephones and standard blanks, etc., for telephone-train dispatching.

ALLIS-CHALMERS EQUIPMENTS.—Among recent sales by the Allis-Chalmers Company are the following: A 200-kw, direct-connected Corliss engine and direct-current generator to the Hudson Company store, Detroit; a 550-kw Corliss engine and direct-current generator to the Wisconsin Steel Company, Chicago; an electric motor equipment for the works of the B. J. Johnson Soap Company, Milwaukee; fifteen three-phase induction motors ranging from 10 to 75 hp to the Montezuma Copper Company, Sonora, Mexico; turbines, electrical generating and motor machinery for the city of Paw Paw, Mich.; 150-kw, three-phase alternator and exciter to the corporation of East Toronto, Ont.

THE BERKSHIRE ELECTRIC COMPANY, of Pittsfield, Mass., carried on for many years by C. G. Tompkins, is being reorganized by A. E. Truesdale and G. H. French. The new corporation will retain the name of the Berkshire Electric Company, and it is the intention of the new owners to enlarge the territory and the scope of its business. The company will be prepared to furnish designs and estimates for electrical installations of all descriptions, as well as power plants, telephone systems and the entire mechanical equipment of buildings. The manufacture of electric and gas fixtures will be continued and enlarged and the sale of electrical materials will be carried on as in the past. Mr. Tompkins will still be associated with the company.

EUGENE MUNSELL & COMPANY, the well-known dealers in mica, and the Mica Insulator Company, manufacturers of micanite and other high-grade electrical insulators, for many years located at No. 218 Water Street, New York, have removed to No. 68 Church Street, corner of Vesey Street. Owing to the increase in their business, they were compelled to seek more commodious quarters, and their new location is one of the most central in the downtown business district, being only one block west of Broadway, and within five minutes' walks of the principal railways and ferries. They occupy four floors at their new location, the second floor being devoted entirely to their offices, while the other three are used for stock and shipping departments, for the preparation and sorting of mica and for the manufacture of mica specialties.

THE ELECTRIC STORAGE BATTERY COMPANY of Philadelphia will have an interesting exhibit at the convention of the American Street and Interurban Railway and Manufacturers' Association at Atlantic City, Oct. 14, and among other materials will show one element of type 71-R in a containing tank sufficiently large to hold 83 plates of this type, the tank showing the standard method of re-enforcement used on cells at the end of rows. A 12-pole carbon regulator, recording hydrometer, recording and signaling hydrometer, automatic cell filler and compensating hydrometer will be shown, with examples of positive and negative plates of the different types. The representatives who will be present are Messrs. Charles Blizard, third vice-president; Albert Taylor, manager New York office; G. H. Atkin, manager Chicago office; E. L. Reynolds, manager Pennsylvania sales office; H. B. Gay, manager Cleveland office and Robert C. Hull, district engineer.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutical Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, October 17-19, 1907.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, fourth Friday of each month.

American Street & Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, United Engineering Societies Building, 29 West 39th St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

American Street & Interurban Railway Association. Secretary, Tillson, Municipal Building, Brooklyn, N. Y.

Association of Edison Illuminating Companies. Secretary, H. C. Lucas, 10th and Sansom Sts., Philadelphia, Pa.

Association of Electric Lighting Engineers of New England. Secretary, Wells E. Holmes, 308 Washington St., Newton, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Montreal, Que., June 24, 25 and 26, 1908.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont. Next meeting, Montreal, September 11, 12 and 13, 1907.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St. W., Toronto, Ont.

Central Electric Railway Association. Secretary, W. F. Mulholland, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State Street, Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, November 7, 1907.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas & Electrical Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New England, Philadelphia, Pittsburg and Chicago. Meetings in New York, second Friday of each month.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Detroit, Mich., 1908.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles West.

IOWA ELECTRICAL ASSOCIATION. Secretary, L. B. Spinney, Iowa State College, Ames, Ia.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia. Next meeting, Cedar Rapids, Ia., second Tuesday, March, 1908.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., Oct. 16, 1907.

KENTUCKY INDEPENDENT ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Houck McHenry, Jefferson City, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NATIONAL INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb. Next meeting, Omaha, June, 1908.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, F. W. Ballard, 104 Canal St., Cleveland, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Charles W. Ford, Oklahoma City, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex. Next meeting, El Paso, Tex.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass. Next meeting, March, 1908.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 24, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

866,618. ELECTRIC WATER FILTER; Melvin A. Brannon, Grand Forks, N. D. App. filed April 11, 1906. An electric filter for drinking water adapted for household use and which provides both a porous filtering medium and electrolytic plates which act upon the water.

866,639. AUTOMATIC TELEPHONE RELEASE; E. W. Fales, Chicago, Ill. App. filed Feb. 9, 1907. In a telephone exchange system, a plurality of selectors and a connector, each connector provided with a release relay, said connector provided with a net, and a trunk-release circuit, including said magnet and relays in series with each other, together with a source of current for energizing said magnet and relays.

866,645. ANTI-HUMMER FOR TELEPHONE AND TELEGRAPH LINES; Nels O. Hagen, Pekin, N. D. App. filed May 4, 1907. A device for absorbing the mechanical vibrations of a telephone wire at the point of its entrance to a dwelling, especially a wooden frame house, which vibrations are stated to be the cause of a loud humming noise in windy weather.

866,646. CONTACT DEVICE; Clarence J. Harter, Ilion, N. Y. App. filed Dec. 3, 1906. Contact device by means of which electric currents may be taken from a trolley wire or other overhead cable at intervals and conducted to operate an indicator in the car.

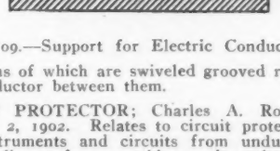
866,667. MEANS FOR FASTENING COLLECTOR LEADS; Emil Mattman, Norwood, Ohio. App. filed Jan. 31, 1907. A dynamo electric machine having a collector ring with an inclined or cone-shaped seat and a collector lead having a wedge-shaped terminal held between the ring and its seat.

866,709. SUPPORT FOR ELECTRIC CONDUCTORS; William W. Benson, Philadelphia, Pa. App. filed Aug. 14, 1905. A supporting device for an electric conductor comprising a wooden block of molding having the usual open channel with side corrugations to hold the conductor.

866,714. TELEPHONE SYSTEM; H. P. Clausen, Chicago, Ill. App. filed Oct. 25, 1901. A telephone system comprising a subscriber's line consisting of two metallic limbs, suitable sub-station apparatus, suitable central-station apparatus, a normally open, low-resistance connection across the terminals of the two limbs at the central station, and a relay for closing said connection, said connection when closed operating to short-circuit the said sub-station apparatus.

866,716. MANUFACTURE OF INCLOSED FUSES; Robert C. Cole, Hartford, Conn. App. filed June 23, 1906. An inclosed fuse comprising an enclosing case, an indicuator wire associated therewith and a metallic holder fastening the end of said wire to the wall of the case and an end closure for the case covering said metallic holder.

866,729. TROLLEY; William Moeckel, Jersey City, N. J. App. filed June 12, 1907. The trolley harp has U-shaped extensions on each



866,709.—Support for Electric Conductors.

side, to the arms of which are swiveled grooved rollers which receive the trolley conductor between them.

866,735. CIRCUIT PROTECTOR; Charles A. Rolfe, Adrian, Mich. App. filed Jan. 2, 1902. Relates to circuit protectors for protecting low-tension instruments and circuits from unduly strong currents; includes an ordinary fuse cartridge and a thermal-circuit breaker which operates in case the fuse cartridge arcs across.

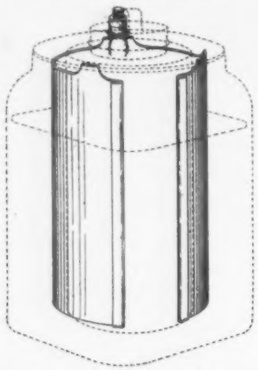
866,748. BATTERY-ZINC; Henry C. Thomson, Boston, Mass. App. filed Dec. 21, 1903. A circular battery-zinc provided at its upper edges with a lip or lips turned back toward and either touching or almost touching upon the main body of the zinc.

866,751. METHOD OF EXHAUSTING INCANDESCENT LAMP BULBS; Frank L. O. Wadsworth, Pittsburg, Pa. App. filed Feb. 28, 1906. A method of exhausting incandescent lamp bulbs—consists in employing the flow of a fluid to control the successive steps or operations during the process of exhaustion.

866,760. POLARIZED RINGER MAGNET; Francis H. Whitman, Cambridge, Mass. App. filed Dec. 31, 1906. Details of construction of a magnet having a yoke support for the armature, which is rigidly held by the cores of the electromagnet.

866,770. ELECTRIC CONDUCTOR MOLDING; Sidney M. Burk, Philadelphia, Pa. App. filed Feb. 9, 1906. Improvement in electric conductor moldings employed in buildings and other structures for the purpose of supporting the electrical conductor wires. Designed to exert a resilient gripping action on the wires.

866,772. DOOR FOR FIRE-ALARM BOXES; Frank G. Campbell, Washington, D. C. App. filed Oct. 31, 1905. Keyless door for fire-



866,748.—Battery Zinc.

alarm boxes designed to be applied to boxes in ordinary use and so constructed that the main alarm mechanism will be set in motion when a member located upon the exterior of the box is actuated.

866,781. TROLLEY; George R. Forster, Fithian, Ill. App. filed April 27, 1907. A retrieving device for a trolley pole including a pneumatic cylinder having a piston normally spring impelled in one direction.

866,794. INTERCOMMUNICATING TELEPHONE; Chas. E. Lee, Chicago, Ill. App. filed Feb. 28, 1906. In intercommunicating telephone devices the combination with the pivot telephone-hook, of an extension thereof beyond the pivot forming a latch thereon, a circuit connecting mechanism controllable by said latch, a push button controlling the relations of said latch with the circuit-connecting mechanism aforesaid, and a circuit-connecting mechanism or switch for connecting with any desired number of terminal points; substantially as described and shown.

866,810. ELECTRIC LAUNDRY IRON; Earl H. Richardson, Ontario, Cal. App. filed Oct. 10, 1906. Construction of flat-iron having an interior hollow chamber with a pair of heating coils.

866,820. ELEVATOR MACHINE; George L. Smith, Chicago, Ill. App. filed Aug. 11, 1906. An electric motor for elevators having special arrangement of gears by which different speeds are secured.

866,846. ELECTRIC LOCOMOTIVE CONTROLLER; Charles O. Dayton, Washington, Iowa. App. filed Oct. 8, 1906. Block-signaling system for single-track trolley roads having a register by means of which the number of cars which enter a block in either direction is taken account of.

866,849. METHOD AND PROCESS FOR THE RECOVERY OF COPPER AND OTHER METALS FROM THEIR ORES; Charles H. Ehrenfeld and Jacob R. Grove, York, Pa. App. filed Sept. 7, 1906. Relates to a method of the recovery of metals from their ores in which the metal is dissolved out of the ore into a solution of a suitable solvent agent by the aid of electricity and thereupon electrically deposited out of such solution.

866,858. APPARATUS FOR DEPOSITING METALS; Wilbur A. Hendryx, Denver, Col. App. filed June 30, 1905. A depositing cell comprising an open frame, a filtering medium carried thereby, and metal-depositing means within said frame.

866,859. APPARATUS FOR DEPOSITING METALS; Wilbur A. Hendryx, Denver, Col. App. filed June 30, 1905. An apparatus for depositing gold, silver and copper from cyanide solutions; comprises an anode, a cathode surrounding the same, and a filtering envelope applied to the exterior surface of said cathode.

866,945. ELECTRIC SIGNALING ON RAILWAYS; William J. MacKenzie, Dunmuiry, Eng. App. filed Dec. 13, 1905. Railway system for signaling between rails. Includes special trolleys between the track rails which complete circuits to the engine cab by means of rollers depending therefrom.

866,959. ELECTROPLATING APPARATUS; Louis Potthoff, Flushing, N. Y. App. filed May 1, 1906. An apparatus for electroplating small articles, such as nails, etc. Includes a tank with a feeding device for impelling the objects through said tank.

866,977. CUT-OUT; Joseph G. Swallow, New York, N. Y. App. filed April 4, 1907. Cut-out box in which all the electrically live parts are so covered that access from the outside is impossible. Has means for sealing the covering plate so that it cannot be removed by unauthorized persons.

866,983. RAILWAY SWITCH; Guy M. Thompson, Seattle, Wash. App. filed Nov. 26, 1906. The switch-point has a pair of connections with separate iron cores which are acted upon by solenoids in separate circuits.

866,990. ELECTRICAL MEASURING INSTRUMENT; Thomas W. Varley, New York, N. Y. App. filed Sept. 7, 1905. Electrical measuring instrument having a substantially constant magnetic field in combination with stationary and movable coils so disposed that a current passing through the stationary coil will shift or distort the lines of force of the constant magnetic field so as to cause a torque on the movable coil.

867,014. TELEPHONE EXCHANGE SYSTEM; Edward E. Clement, Washington, D. C. App. filed Dec. 10, 1904. In a telephone system, a line, a line relay, a cut-off relay, and means whereby each relay controls the operative connection of the other.

867,021. ELECTRIC CONTACT RAIL AND SHOE; George Drawert, Chicago, Ill. App. filed May 14, 1906. A third rail having a groove on its under side with underhanging lips so as to positively guide a collector shoe from all sides.

867,046. ELECTROMETALLURGICAL PROCESS FOR EXTRACTING COPPER FROM ITS ORES; Lucien Jumau, Paris, France. App. filed Dec. 29, 1905. An electrometallurgical process for extracting copper from its ores consisting in various detail features of an ammonical leaching process.

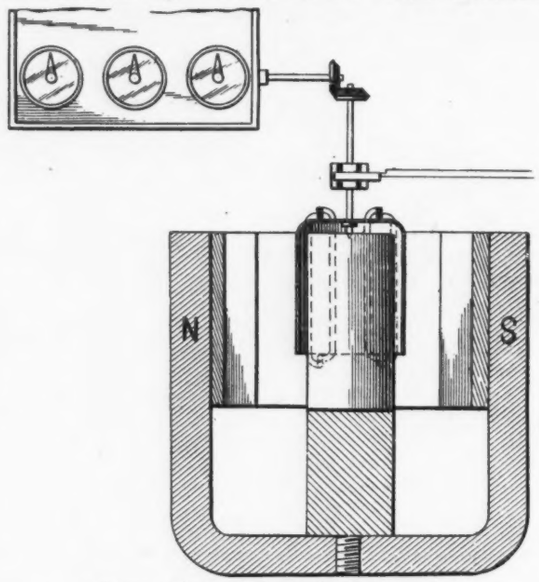
867,065. SYSTEM OF ELECTRICAL DISTRIBUTION; Louis C. Marburg, Norwood, Ohio. App. filed Aug. 30, 1905. In a system of distribution, one or more alternating-current generators, a transformer having a plurality of low-tension windings, means for connecting the generator or generators to one of said low-tension windings, one or more converters, and means of connecting a converter to another low-tension winding.

867,125. TROLLEY WHEEL SUPPORT; George W. Grisdale, Jr., Philadelphia, Pa. App. filed March 5, 1906. The trolley harp is swiveled on a vertical axis at the end of the trolley pole and the swivel bearing is capable of movement out of its vertical plane.

867,140. MOLDING FOR ELECTRIC WIRING; William H. G. Kirkpatrick, Philadelphia, Pa. App. filed April 27, 1906. A molding having a member provided with longitudinal grooves with an intermediate mortised partition and an interlocking keeper whose length is considerably less than the width of the molding.

867,147. RAIL MAGNETIC BRAKE; Victor L. Ochoa, New York, N. Y. App. filed Jan. 5, 1907. A specially constructed magnet is suspended by links between the wheels of the truck so as to exert a magnetic breaking action on said wheels and on the track rail.

867,150. RAILWAY SIGNALING APPARTUS; Vincent L. Raven, Darlington, Eng. App. filed April 18, 1907. Details of construction



866,990.—Electrical Measuring Instrument.

of a complete railway signal system employing special contact plates between the track rails.

867,151. RAILWAY SIGNALING APPARATUS; Vincent L. Raven, Darlington, Eng. App. filed April 23, 1907. Relates to modifications of the above.

867,152. RAILWAY SIGNALING APPARATUS; Vincent L. Raven, Darlington, Eng. App. filed April 23, 1907. Covers additional modifications.

867,154. SYSTEM OF MOTOR CONTROL; Walter J. Richards, Norwood, Ohio. App. filed Sept. 29, 1906. In combination, a generator, a motor supplied thereby, and field windings for controlling said generator and said motor, respectively, which are in shunt to one of the mains connecting the generator and the motor.

867,155. MOTOR CONTROL SYSTEM; Walter J. Richards, Norwood, Ohio. App. filed March 1, 1907. In combination, a controlling device, and a plurality of operating handles arranged to move said controller positively when themselves moved in one direction and to merely give a bias to the controller with themselves moved in the other direction.

867,168. CONTROLLER-REGULATOR; Emmett W. Stull, Norwood, Ohio. App. filed March 30, 1907. In combination, a controller handle, a fixed notched member and a pawl carried by said handle and arranged to be moved by the same force to engage the notches of said member to stop the handle as the latter is moved forward, and to be released therefrom subsequently.

867,192. FLOATING POWER PLANT; James W. Dawson, San Francisco, Cal. App. filed Sept. 13, 1906. A float has paddle-wheels on each side geared to a dynamo, and mechanism is provided for lifting them out of the water in accordance with the current needs of the system.

867,197. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Clayton W. Hamm, York, Pa. App. filed Dec. 19, 1906. Electric railway signal of the block type used in connection with the single-track electric railways having turn-outs at frequent intervals to permit the passage of cars in opposite directions. Has ratchet operated mechanism for registering the number of cars in the respective directions.

867,211. CIRCUIT MAKING AND BREAKING DEVICE; Andrew L. Riker, Bridgeport, Conn. App. filed Jan. 18, 1904. A vibrator for an induction coil having a contact member and impact means operated by the core magentization for enforcing the making of the circuit at such contact member.

867,212. ELECTRICAL CIRCUIT PROTECTOR; Charles A. Rolfe, Rochester, N. Y. App. filed Sept. 18, 1905. A thermal protector for telephone systems of the type having spring blades enclosing cartridge fuses and separated by a carbon block constituting a lightning arrester.

867,220. CIRCUIT CLOSER FOR DOOR ALARMS; Louis E. L. Themke, Strathcona Alberta, Canada. App. filed March 14, 1907. A circuit closer adapted to be applied to an ordinary door-knob within the interior of the door so as to close an alarm circuit when the knob is turned.